AUTOMOTIVE and Aviation INDUSTRIES

JULY 15, 1942

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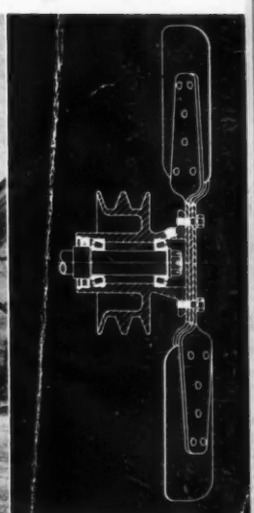

Both commercial and military truck fans present an ideal application for Timken Tapered Roller Bearings. Fan bearings at all times must carry combined radial and thrust loads; radial loads from the belts, thrust generated by the fan blades. The carrying of radial-thrust loads in any combination is a job at which the Timken Bearing cannot be beaten.

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AUTOMOTIVE and Aviation INDUSTRIES

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Volume 87 Number 2

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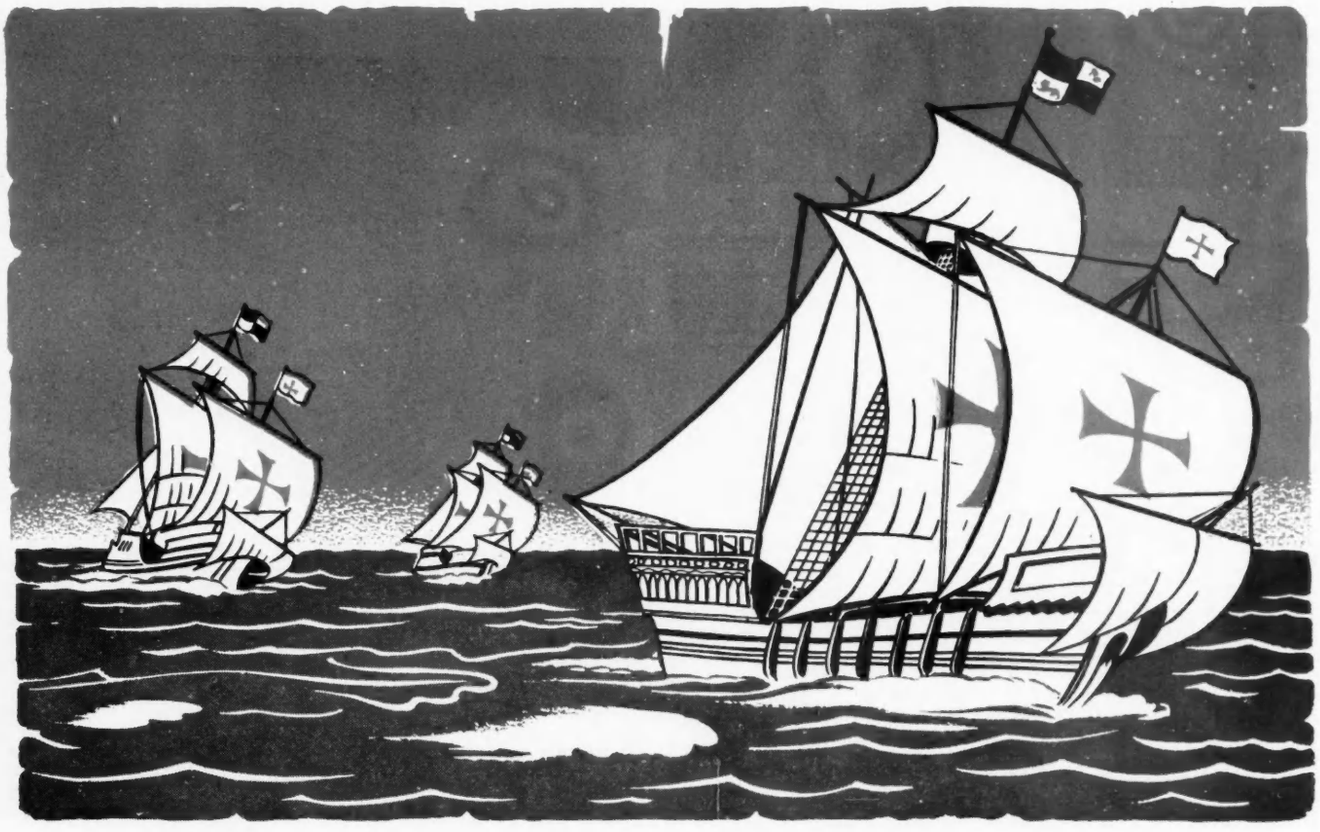

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AUTOMOTIVE and AVIATION INDUSTRIES

Volume 87 July 15, 1942 Number 2

Germany's New Dornier 217E Warplane 18

The material for this description of one of Germany's newest bombers was obtained by the British from a thorough inspection of a wrecked plane. The specifications listed will be of value in comparing it with current American aircraft.

New Research Facilities for NACA in Three Strategic Locations 24

The work of the National Advisory Committee for Aeronautics has been a major factor in the development and application of new aeronautical designs. This article describes the new facilities which will be used in the all-important quest for more efficient warplanes.

Plywood Planes by the Vidal Process 28

The Vidal process for using plastic-bonded plywood in the construction of light planes promises to make available many tons of scarce metals for other applications. This article outlines the initial production problems and describes the present methods of construction.

The Short Stirling Heavy Bomber 30

The four pages of details in this issue supplement the description of the Stirling bomber which appeared in a recent issue of AUTOMOTIVE *and* AVIATION INDUSTRIES. You will find much interesting information on these pages.

Flexibility Features Reorganized Manufacturing Operations of Pump Engineering Service Corp. 38

Since the acquisition of this corporation by the Borg-Warner Corp., extensive changes have been made in the layout of the production system. It will pay you to read this article which shows how the company handles dozens of models of fuel pumps, vacuum pumps, hydraulic pumps, and valves.

Chrysler Packaging System for Army Replacement Parts 42

To withstand the penetrating frost of Iceland and the sizzling moist heat of the tropics, spare parts packages have been thoroughly designed and standardized by Chrysler engineers. Read this article to see how American automotive ingenuity has solved this important problem.

Bullard's New Reclamation System 44

A system for salvaging cutting oils, metal chips, and woolen and cotton wastes has been installed in the Bullard plant. Your reading of this article may lead to the solution of one of your own salvage problems.

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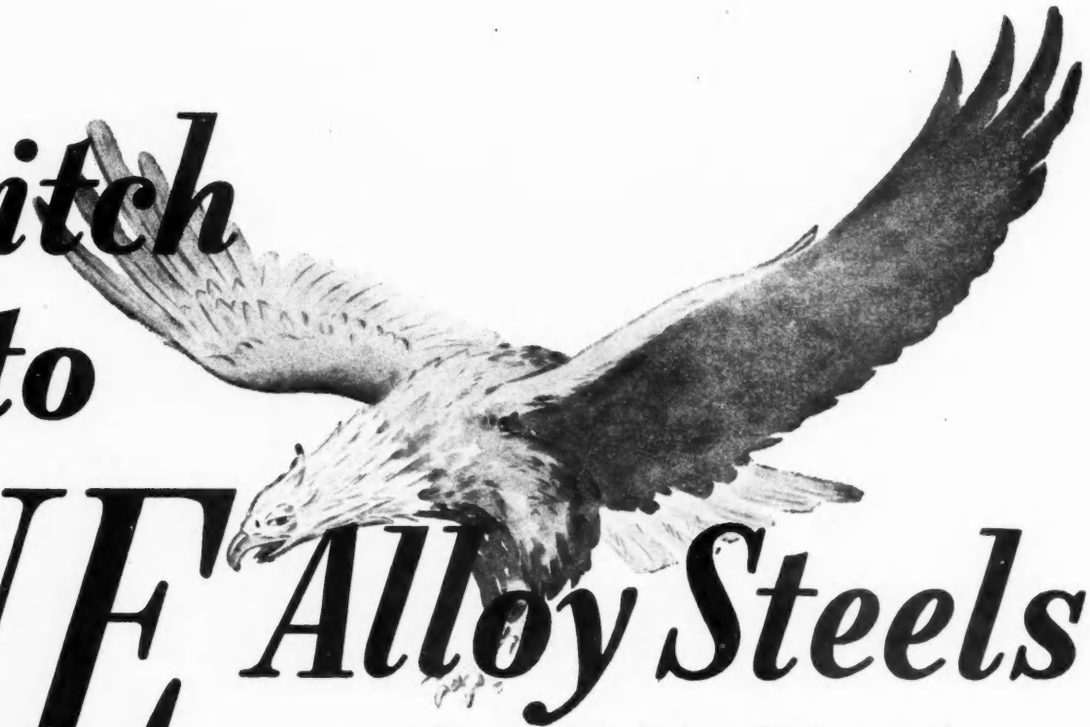

to Save Critical Metals

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Only limited data on heat-treatment response or physical properties will be available when NE Alloys are first ready for shipment. The WPB is anxious to know how these new steels will function and requests all NE Alloy users to report results in working with these new steels. Ryerson will cooperate fully with users, supplying laboratory test data, and all other available information.

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AUTOMOTIVE and AVIATION INDUSTRIES

Published on the 1st and 15th of the month

Vol. 87, No. 2
July 15, 1942

Doing More, Faster, with Less

Ingenuity in Mass Production, Chief Contribution of Automotive Industry to War Effort

By Donald M. Nelson
Chairman of War Production Board

THIS article is made up of extracts from the speech prepared by Donald M. Nelson for the first annual meeting of the Automotive Council for War Production. A report of the meeting, attended by 1200 executives from the industry, will be found on page 54 of this issue.

IN ITS major role in the war effort the automotive industry will be producing war goods at the annual rate of $12 billions when peak rates of production are reached under present plans, an amount representing approximately one-sixth of the entire war production effort of the whole United States. These figures show what is ahead for the industry, which is entitled to feel a great deal of honest pride in the fact that such great reliance is placed upon it in this time of national peril. The automotive companies today are so thoroughly formed into a war industry that at times it is hard to remember that they ever were anything else.

During this calendar year, the factories of the United States will turn out war goods of one kind or another to a value of approximately $45 billions. Next year I expect that that figure will rise to $70 or $75 billions. At current prices, I do not believe that it can ever rise much above that figure, because I think that that is just about the limit that our economy can stand. The materials which would be needed to get production substantially higher than that simply are not available, and as far as we can see now they cannot be made available. But in any case, getting up to the $45-billion level this year will be a splendid achievement, and raising the level to $75 billions next year will be nothing less than magnificent.

Let's look, for example, at the most recent production figures. During May, the automotive industry turned out $63-million worth of aircraft engines and $24-million worth of tanks. That is cause for honest pride, of course. Yet the bulk of the production of those two important items came from new plants started prior to Pearl Harbor. Furthermore, by the time this year ends, we have got to raise airplane engine production to a rate of better than $150 million a month and tank production must increase more than fourfold. In addition, while it is true that during April—the last month for which complete figures are available—more than 80 per cent of this industry's total output consisted of war goods. It is also true that total production by the industry during April had not yet reached half the level of peak monthly production in 1941.

The hard part of this job has barely started. The utilization of existing facilities is still, in a number of instances, relatively low. The industry still possesses a large number of idle machine tools, and the job of making these tools available for use outside of their old lines has little more than begun. I believe that much remains to be done in the way of analyzing the jobs being done in the various plants and determining which idle tools in other plants might be reallocated to do the work. This is of particular importance because the pressure generated by our war program has now become so great that we cannot afford to use either man-power or materials to make any new tools if there is a possible chance to get the

(*Turn to page* 56, *please*)

Germany's

Electrical control equipment and engine cooling system among features of this multiple purpose bomber

THE BRITISH Ministry of Aircraft Construction has issued a detailed report concerning the design and construction, aerodynamic features and equipment of the Dornier Do 217E-1, a type of German aircraft now used extensively as a bomber, a dive-bomber equipped with an automatic pull-out-of-dive mechanism, a torpedo bomber, or for mine-laying. The report is based upon minute examination of a machine of the bomber type which crashed in England in a condition permitting practically every part to be closely inspected before or after dismantling.

The machine is a high wing monoplane with two BMW 801 double-row 14-cylinder engines, twin fins and rudders on an adjustable tailplane and accommodation for a crew of four. In many respects it resembles the earlier Do 17Z in appearance, structural design and the wide use of electrical services. The compartment for the crew (pilot, bomb aimer, top rear gunner —who also serves as radio operator—and bottom rear gunner) is entirely forward of the wing leading edge.

Relative to the Do 17Z, the wing span has been increased by about 4 ft to 62 ft 5 in. There is no dihedral on the top surface. Slotted ailerons are fitted. The flaps are of the split type but have a shaped nose gap and do not extend to the trailing edge of the wing and are divided by the engine nacelles. The angle for landing appears to be about 60 to 70 deg. The span of the tail has been increased from that of the Do 17Z to bring the twin fins into the same position in relation to the engines. Tailplane incidence can be changed by means of a large diameter wheel in the cockpit and may be automatically changed when the landing flaps are lowered. Each elevator has two tabs, one for balance and trimming and the other, electrically controlled, for automatic recovery from dives with diving brakes.

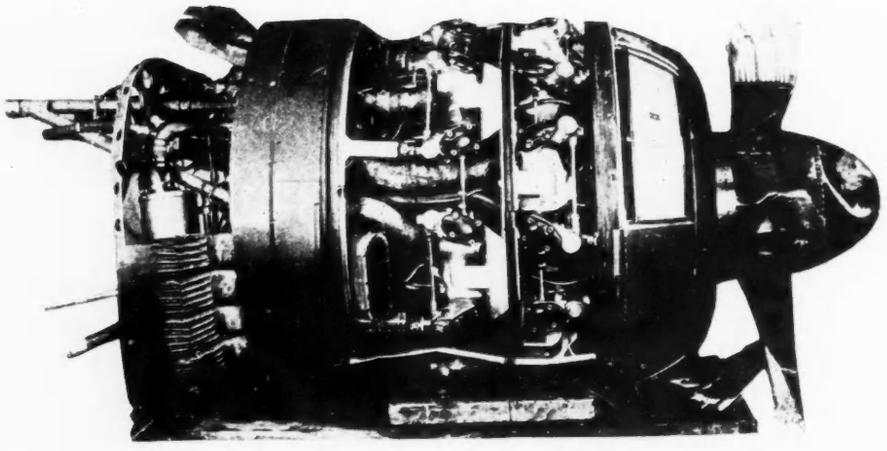
The twin fins and rudders differ extensively from those of the Do 17Z. The fins have fixed slats, the trailing edge of these being on the inside of the fins. The slats are fitted, presumably, to prevent one fin from stalling (with possible over-balance of the rudder) when flying with large angles of sideslip, as when flying on one engine. The rudders have a very narrow horn balance used mostly for mass balancing. The tab extends the full span of the rudder.

The electrical installation and other fittings show that dive brakes of novel design can be fitted. These are positioned well behind the tail unit, but provision is made to fit an alternative unit and this was fitted in the machine examined. Whichever unit is fitted is supported by plungers engaging on four strong points at the top, bottom and each side of the fuselage. These plungers can be disengaged by operating a crank handle in the cockpit, thus jettisoning the unit. An instruction plate near the jettison handle states: "Emergency jettisoning of dive brakes. Pull lower lever—press red knob—turn crank clockwise—after jettisoning, pull out crank and pull upper yellow knob sharply once."

A torsion rod extending from the cockpit to the rear end of the fuselage has a free splined (for jettisoning) end, which probably fits on to a screw jack operating the dive brakes. There is also a thin cable with a free end.

A two-way switch is found on the left side of the pilot's instrument panel. One way operates the dive brakes and the other adjusts the trimming tab for the automatic pull-out. A press knob in the center of this switch presumably operates the pull-out electrically. A contacting altimeter is fitted.

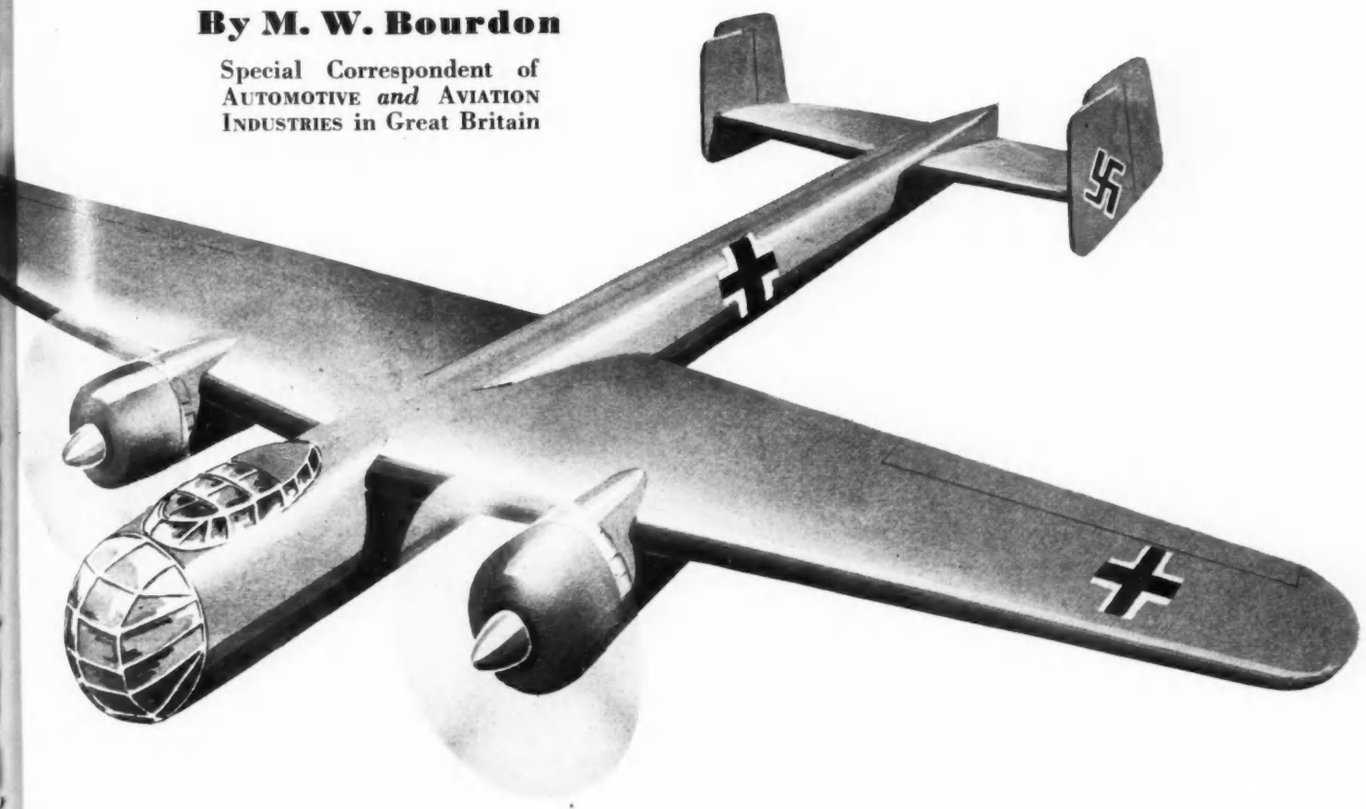
The cooling arrangements of the two BMW 801 air-cooled engines are distinctive. They are referred to later, but here it may be said that behind the propeller, and occupying the ring between a rather small diameter spinner and the lip of the cowling, is an engine driven fan; no cooling gill



BMW 801 powerplant cooled by unique system to effect drag reduction.

By M. W. Bourdon

Special Correspondent of AUTOMOTIVE *and* AVIATION INDUSTRIES in Great Britain



New Dornier 217E Warplane

This article, the first part of which is presented in this issue of AUTOMOTIVE *and* AVIATION INDUSTRIES, *describes the E-1 model of the new Dornier 217 bomber. The second part, which is devoted to the controls, armament armor, bomb installation, electrical and radio equipment, and instruments, will appear in a forthcoming issue.*

A later version of the Dornier 217 warplane, the E-2 model, is reported to be equipped with two BMW radial 18-cylinder, 2000-hp engines; an electrically-operated two-gun turret located over the cockpit; and additional dive brakes under the wings. Its maximum speed is estimated at 324 mph as compared to 309 mph for the E-1 model.

are provided. The air intake is inside the cowling behind the fan and so is the oil cooler. This specially designed cooling system, which reduces drag by an appreciable amount, is estimated to add the equivalent of several hundred horsepower to the rated output of the two engines.

Normal control for both flaps and undercarriage is electrical. The wheel used for adjusting the tailplane is used also for emergency operation of the flaps and undercarriage. The three trim control wheels are mounted in one box, as on the Junkers Ju88.

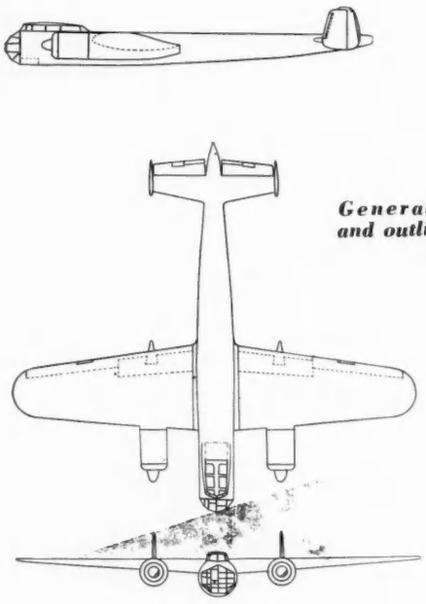
An instruction plate in the cockpit gives the following limits of diving speeds:

Height	With Dive Brakes	Without Dive Brakes
Up to 3 km	575 km/hr	610 km/hr
Up to 5 km	550 km/hr	
Up to 7 km	500 km/hr	
Above 7 km	450 km/hr	
Near the ground, 0 km	340 km/hr	
With flaps and undercarriage down, 0 km	240 km/hr	

A nose hook for assisted take-off and a support for the rear end of the fuselage were found.

Wing and Fuselage Construction

The wing of the Do 217E-1 is in three parts. The center section is 29 ft 5 in. in width and incorporates a portion of the fuselage. The two engine nacelles are also carried on this part of the wing. The two outer portions of the wing are each 16 ft 6 in. in length. Two spars are used in each part of the wing and throughout the span both spars have T-section flanges. In the center section the front spar has a double web,



General arrangement and outlines of Dornier 217E.

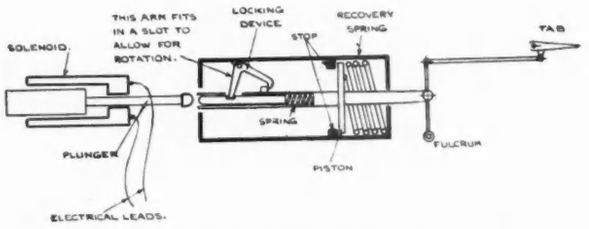


Diagram of operating mechanism of auto-tabs of elevators.

the rear one being a solid plate web and the front one a lattice web, the bracing members being of T-section. The whole of the rear spar and the outer sections of the front spar have lattice webs with T-section bracing members. A number of solid plate ribs are used.

The attachment of the outer portion of each wing to the center section is by four large bolts at each spar and about 20 smaller bolts through corresponding flanges on the inner and outer wings around the periphery of the wing section between the spars.

Three parts go to the make up of the fuselage. They are the nose, a portion integral with the wing center and the rear end. Each part is joined to the next by about 25 bolts passing through flanges riveted to the skin. The fuselage is of stressed skin construction with Z-section and T-section stringers in the proportion of about three to one. Fuselage formers are Z-section.

As previously mentioned, the crew is confined to that part of the fuselage forward of the wing leading edge. The rest of the fuselage, to within a few feet of the tail, is divided in a horizontal plane, the lower half forming the bomb cell, while the remainder contains transverse bracing frames to support the weight of the bomb load. There are three pairs of bomb doors.

The engine mountings are welded steel tubular structures connected to the front wing spar fittings by four spherically seated joints with castellated nuts, which are locked by a spring-loaded pin through the spar fitting. The rubber-bushed mounting blocks on the mounting ring are rather massive for a radial engine, being about 3 in. in outside diameter. The undercarriage has double oleos and is electrically operated, retracting backwards into the engine nacelles.

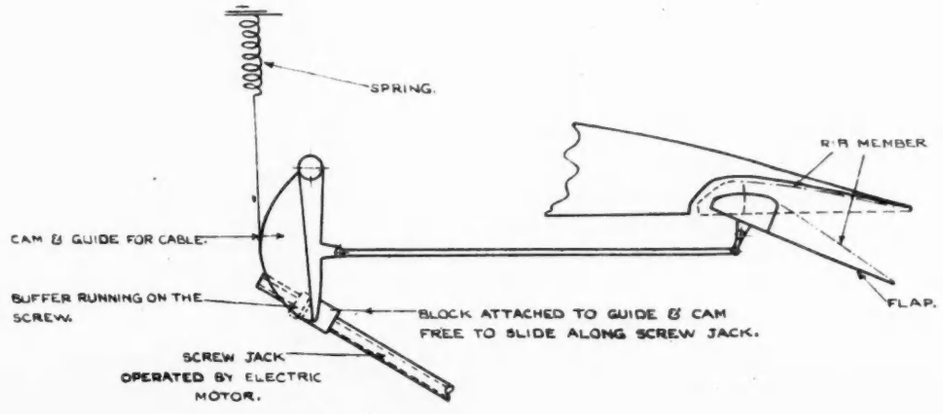
Each tailplane and fin has two spars. The control surfaces are all metal covered and movement of these is effected mainly by pushrods and levers. The elevator control is interesting, for, instead of the control wheel being mounted on a column hinged at the bottom, it is mounted on a horizontal bar projecting from under the center of the instrument panel. This bar has a rack on its upper surface which engages with a pinion behind the instrument board to operate the elevators. Plastic material is used for guide brackets for some of the control rods.

Propellers

The propellers (right-hand tractor rotation) are three-bladed fully feathering with Schwarz type blades. All of the latter had been broken off at about half their length, but it was possible to estimate the propeller diameter as between 12 ft 9 in. and 13 ft. It appears that pitch change is effected by a hydraulic pump mounted on the engine nose, the pump being controlled by an electric motor, while an adjacent hydraulic speed governor interconnected with the throttle control constitutes an automatic control brought into operation by a two-way switch.

Heating and De-icing

Muff type heaters are fitted round four exhaust pipes, two supplied with fresh air from the forward facing pipes for cabin heating and two receiving air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FLAP.
SCREW JACK OPERATED BY ELECTRIC MOTOR.

Mechanism for operating wing flaps.

which has passed over the cylinders for wing leading edge and bomb compartment.

A tank for propeller de-icing fluid is fitted in the undercarriage compartment and is pipe-connected to a slinger ring on the cooling fan and thence to another on the propeller hub. From this second ring fluid is picked up by a small bore pipe which supplies a trough on each propeller blade hub. From this point another small bore pipe embedded in the leading edge of each blade carries the fluid, later dividing into two pipes which emerge on the leading edge at about 18 in. and 36 in. radius, respectively, to direct the ejected stream along it.

Engines

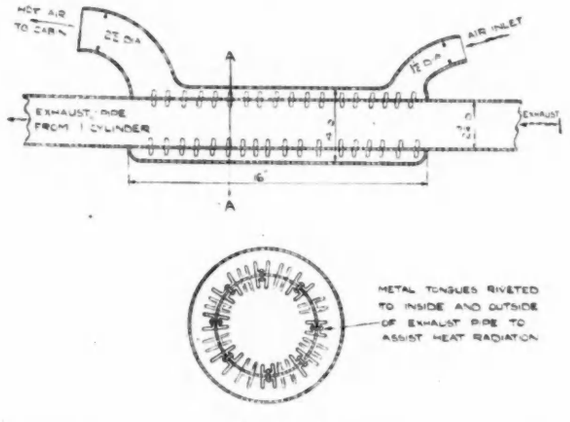
The two BMW 801 engines, which develop 1580 hp each for take-off and 1300 hp each at 18,000 ft., have their 14 air-cooled radial cylinders in two staggered banks, the top cylinder of the rear bank being vertical. A card in the cockpit gives the following information regarding boost pressure, engine speeds, etc., as shown by the accompanying table:

ENGINE DATA

	Time	Boost* Pressure	RPM Under 5 km	RPM Over 5 km
Start	1 min	1.32	2700	
Climb Combat Power	30 min	1.27	2400	
Continuous Power	Continuous	1.15	2300	2400
		1.10	2100	2400
		1.05	2000	2400
Economical Power		1.00	1900	2400
		0.95	1800	2400
		0.90	1700	2400
		0.85	1560	2400

* In ata (1 ata = 1 kg cm²)

(Markings on the control panel and instruments indicate that the take-off power is allowed for 3 min)


HOT AIR TO CABIN
AIR INLET
EXHAUST PIPE FROM 1 CYLINDER
EXHAUST
A
METAL TONGUES RIVETED TO INSIDE AND OUTSIDE OF EXHAUST PIPE TO ASSIST HEAT RADIATION
SECTION A A

Heater muff for cabin heating and for hot air sprays on nose windows and pilot's screen.

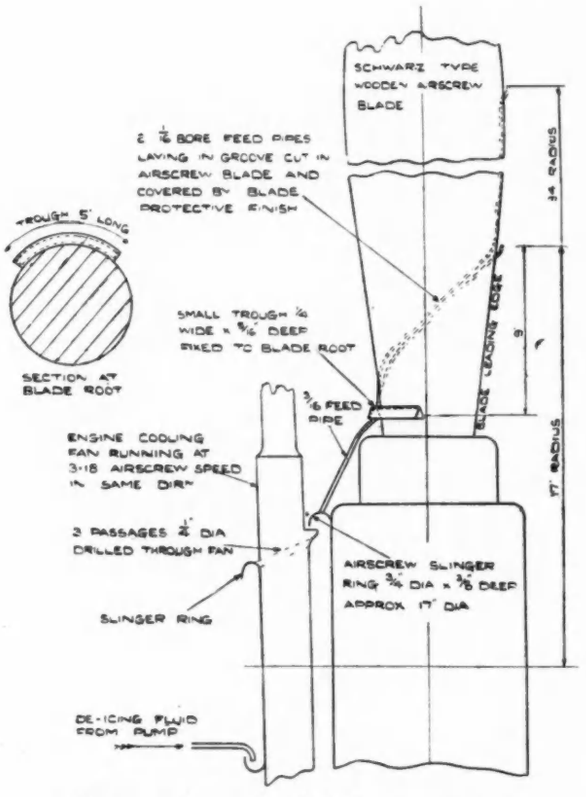
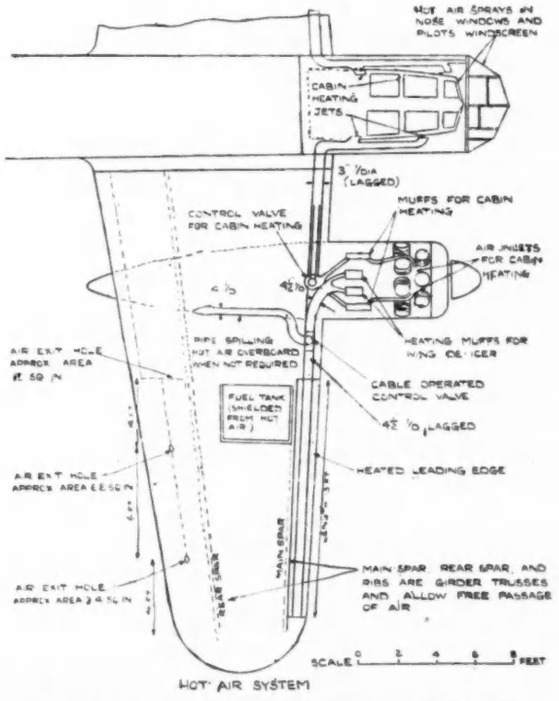
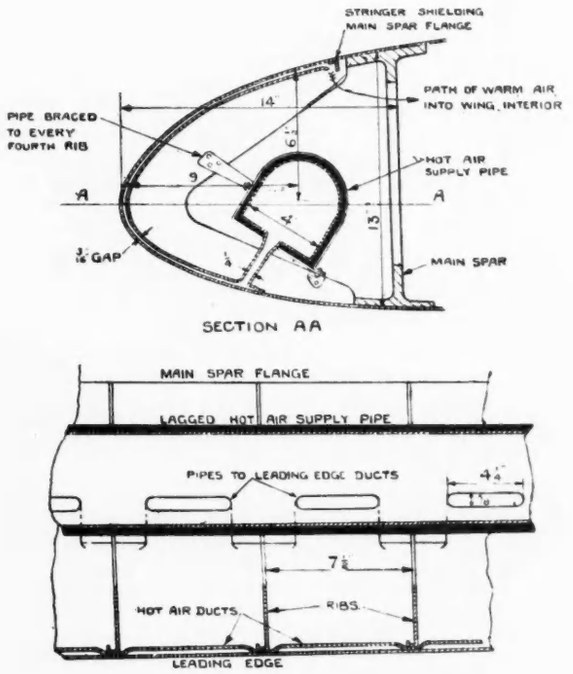

SCHWARZ TYPE WOODEN AIRSCREW BLADE
2 ⅛ BORE FEED PIPES LAYING IN GROOVE CUT IN AIRSCREW BLADE AND COVERED BY BLADE PROTECTIVE FINISH
TROUGH 5" LONG
SECTION AT BLADE ROOT
SMALL TROUGH ⅛ WIDE x 5/16 DEEP FIXED TO BLADE ROOT
BLADE LEADING EDGE
24" RADIUS
17" RADIUS
⅜ FEED PIPE
ENGINE COOLING FAN RUNNING AT 3·18 AIRSCREW SPEED IN SAME DIRN
3 PASSAGES ¾" DIA DRILLED THROUGH FAN
AIRSCREW SLINGER RING ¾" DIA x ⅜" DEEP APPROX 17" DIA
SLINGER RING
DE-ICING FLUID FROM PUMP

Diagram of propeller de-icing arrangement.

The fuel injection pump differs from that on the BMW 132 engines. It is of cylindrical form mounted on the engine rear, with a bakelized fabric control capsule case and servo unit similar to the previous type. A mixture control is not fitted. New type injectors are fitted in the cylinders, at the rear between the valves. A small oil tank at the engine rear supplies


HOT AIR SPRAYS ON NOSE WINDOWS AND PILOTS WINDSCREEN
CABIN HEATING JETS
3" DIA (LAGGED)
MUFFS FOR CABIN HEATING
CONTROL VALVE FOR CABIN HEATING
AIR INLETS FOR CABIN HEATING
PIPE SPILLING HOT AIR OVERBOARD WHEN NOT REQUIRED
HEATING MUFFS FOR WING DE-ICER
AIR EXIT HOLE APPROX AREA 12 SQ IN
CABLE OPERATED CONTROL VALVE
FUEL TANK (SHIELDED FROM HOT AIR)
4½" DIA LAGGED
HEATED LEADING EDGE
AIR EXIT HOLE APPROX AREA 6·5 SQ IN
MAIN SPAR
MAIN SPAR REAR SPAR AND RIBS ARE GIRDER TRUSSES AND ALLOW FREE PASSAGE OF AIR
AIR EXIT HOLE APPROX AREA 2·4 SQ IN
SCALE 0 2 4 6 8 FEET
HOT AIR SYSTEM

Hot air system for cabin heating and de-icing.



Details of heated leading edge of wing.

a separate pressure pump with oil for the injection pump and boost control, oil servo controls, etc.

The supercharging and induction systems are fitted between the crankcase and the rear auxiliaries gearbox. There are two flat side intakes with entrance grids, and these open by cowling ducts round the cylinders to the front of the engine, receiving air from inside the cowling. The two intake throttles are geared to an oil servo-operated variable datum boost control. There is no control connected which indicates a second supercharger speed.

There is one exhaust and one inlet valve per cylinder, pushrod operated. A Bosch single drive unit magneto is mounted on the nose top, serving two plugs per cylinder, one plug inboard each valve.

The engine and oil tank vents are led to an oil separating chamber; this is behind the engine and has an inner canister packed with metal turnings through which the vents breathe. The cannister drains to the oil sump.

Each cylinder exhausts separately through a pipe terminating in a fitting that has five slotted passages for flame damping, 3 in. by ⅜ in. wide, projecting about 4 in. outside the cowling at the cooling air jet. The pipes are grouped, with six on top and four each side.

The cylinders are closely baffled on head and barrel, and the whole unit with oil cooler is covered by a long chord cowling, 4 ft 6 in. overall diameter, supported by brackets connected to several cylinder rocker boxes with rubber bushed pins. A 12-bladed fan, geared up to about 3¼ times propeller speed, rotates in the same direction as and just in rear of the propeller, in the cowling front opening, which is 2 ft 8 in. in diameter. The blades of the fan are of aerofoil section, 5½ in. high and 4 in. full width.

The oil cooler is fitted in the curve of the cowling

DORNIER DO 217E-I AERODYNAMIC DATA

Weight (Overload) Lbs.		33,500
Power Loading, lb/hp		14
Wing Loading, lb/sq ft		59.4
Span Loading, lb/sq ft		9.52
Propeller Pitch		Variable
Gear Ratio		0.54
WINGS		
Area (Gross) S in sq ft		610
Span = 2s (feet)		62.5
Mean Chord		9.9
Aspect Ratio		6.26
Dihedral	Degs.	1.8
Sweepback	Degs.	1.0
Chord Root	Feet	12.76
Chord Tip	Feet	6.72
Thickness t/c Root	%	17
Thickness t/c Tip	%	8
FLAPS		
Type		Split
Maximum Angle		55
Flap Area/S		0.10
Flap Chord/Local Wing Chord		0.241
Flap Span/2s		0.378
LONGITUDINAL CONTROL		
Tail Area (Gross) = S′ (sq. ft.)		117.6
Elevator Area/S′		0.315
S′/S		0.193
DIRECTIONAL CONTROL		
Fin and Rudder Area (Total) sq. ft. S″		62.8
Rudder Area/S″		0.343
LATERAL CONTROL		
Aileron Area (Total) sq. ft.		40.8
Aileron Area/S		0.067
Aileron Chord/Local Chord		0.242
Aileron Span/2s		0.454
Type		Slotted

nose piece and consists of round tubes with disk fins. The leading edge ring of the cowling is moved fore and aft by several cranks from an electric motor, the ring varying the width of an annular slot controlling the air flow to the cooler, the air returning to the main-flow inside the cowling after passing over the cooler. A cowling sleeve ring at the rear of the cylinders is similarly moved to vary the cooling air exit area.

Performance

The following are estimated performance figures:

Weight	33,500 lb
Total take-off power	3,160 hp
Unassisted take-off distance	1,550 yd
Initial rate of climb	638 ft/min
Power at 18,000 ft (all out, level)	2,600 hp
Maximum speed	309 mph
Cruising ceiling (rich mixture)	19,100 ft

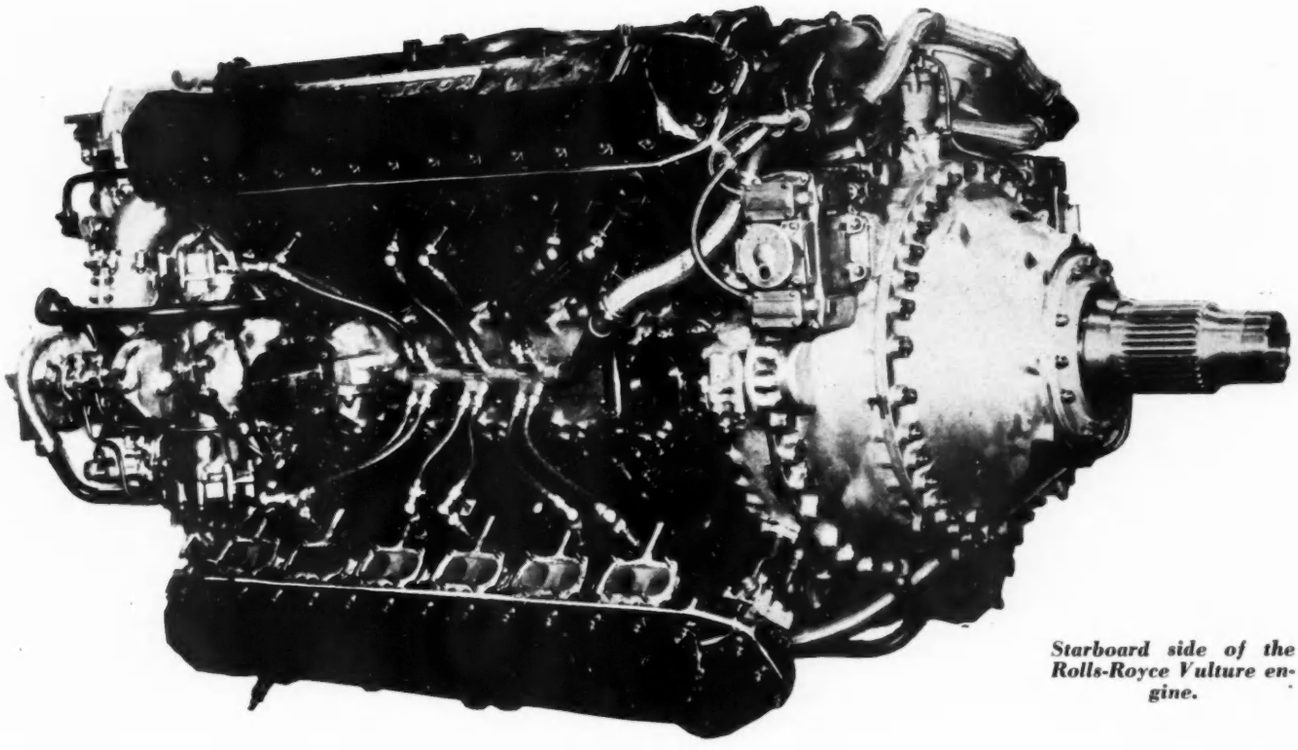
It will be seen that at the estimated weight, the unassisted take-off performance is poor, so that some form of assisted take-off would be desirable; and, as stated in the foregoing, a nose hook for assisted take-off was found.

(*To be continued*)

Rolls-Royce Vulture Engine

By M. W. Bourdon

Special Correspondent of
AUTOMOTIVE *and* AVIATION
INDUSTRIES in Great Britain.



Starboard side of the Rolls-Royce Vulture engine.

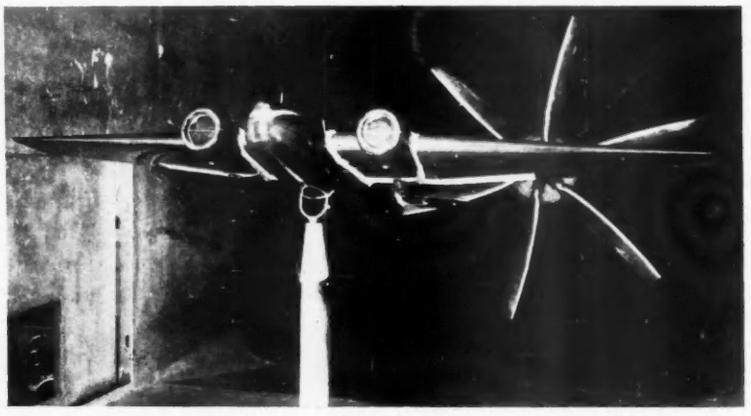
CONSIDERABLY larger and more powerful than any other Rolls-Royce powerplant, the Vulture engine has 24 cylinders arranged in the form of an X. There are four blocks of six cylinders, each mounted on a common crankcase with an angle of 90 deg. between the blocks. Having a piston displacement of 2592 cu. in. (5 in. bore by 5½ in. stroke), the Vulture originally developed 1760 bhp for take-off, but the most recent version has a maximum power output of 1845 bhp at 3000 rpm at 5000 ft. with the low speed supercharger gear in use and 1710 bhp at 3000 at 15,000 ft. with the supercharger high speed gear operating.

As in the Rolls-Royce Merlin engine, the cylinder blocks, cylinder head and coolant jackets are of aluminum, with wet cylinder liners of steel. The crankshaft has seven bearings. There are four overhead valves in each cylinder with overhead camshaft operation, and two spark plugs. Current for the latter is provided by two independent screened magnetos in conjunction with two separate high-tension distributors. An oil relay is used for ignition timing control. Automatic boost control with a two-position mixture control is used with an S.U. downdraft carburetor with twin chokes. The two-speed centrifugal supercharger delivers mixture through two main trunk pipes, each feeding two blocks of cylinders.

The accompanying photograph is the first view of this engine to be released by the British Air Ministry, although the Vulture went into service originally in the autumn of 1940 to power the two-engined Avro Manchester bomber. Although early troubles have been overcome and the Vulture now is regarded as entirely reliable, and the Manchester is well-liked by the bomber crews, the production of both is being discontinued, presumably because the heavy bomber powered by four engines is preferred to one with the two much higher output Vulture engines. Rolls-Royce will concentrate on other production types—the Merlin XX in particular which is used to power the Halifax and new Lancaster bombers. The Lancaster, it may be added, has been described broadly as a four-engined version of the two-engined Manchester, photographs of which were reproduced in the Jan. 15, 1942, issue of AUTOMOTIVE INDUSTRIES. The Lancaster will be built by the same company as the Manchester.

New Research Facilities for NACA in Three St

RESEARCH facilities of the National Advisory Committee for Aeronautics were greatly expanded during the past year. Additions were made to its original laboratory at Langley Field, Va.; various units of the new Ames Aeronautical Laboratory at Moffett Field, Calif., were opened, and construction work was begun on the engine research laboratory at Cleveland, Ohio, authorized early in 1941. One unit of the Cleveland laboratory already is being used, and it is expected that all of the remaining units will be placed in service before the end of the current year.



Interior view of NACA 7 by 10-ft wind tunnel at Langley Field for determining stability and control characteristics.

The National Advisory Committee for Aeronautics was organized in 1915 to prepare the scientific foundations on which practical development of aircraft could be carried on. Its work naturally falls under two principal headings—research intended to evolve new ideas, and development or the application of these ideas to new designs. It is only natural that under the present emergency conditions the greatest emphasis is laid on problems the solution of which promises to yield the most immediate returns. In the NACA annual report for 1941, recently issued, it is stated that as a result of close cooperation with the Army, the Navy, and the aircraft industry, the results of many investigations carried out by the committee are embodied in current-production aircraft, the effectiveness of which as weapons of war has been enhanced thereby.

In 1938, when war clouds first began to show on the horizon, the NACA made a study of the facilities which would be needed to do effective research work in connection with unsolved problems of the airplane, its powerplant, and its equipment, and as a result it proposed the construction of additional, improved wind tunnels to investigate the properties of large airplane models at speeds in excess of current military requirements, as well as the provision of increased

NACA 8-ft high-speed wind tunnel at Langley Field for testing large-scale models and full-size airplane parts at air speeds from 85 mph to more then 500 mph. The test chamber inside the dome operates at reduced pressures, simulating at full speed an altitude of over 12,000 ft.

Strategic Locations

facilities for powerplant research. In response to NACA's proposals, Congress provided funds to increase the research facilities at Langley Field, to provide an electric generating plant to permit operation of the wind tunnels there throughout the day, and to establish a new aerodynamic research station at Moffett Field, Calif., and a separate station for fundamental research on aircraft engine problems. After an extended investigation, Cleveland was selected as the site for this laboratory.

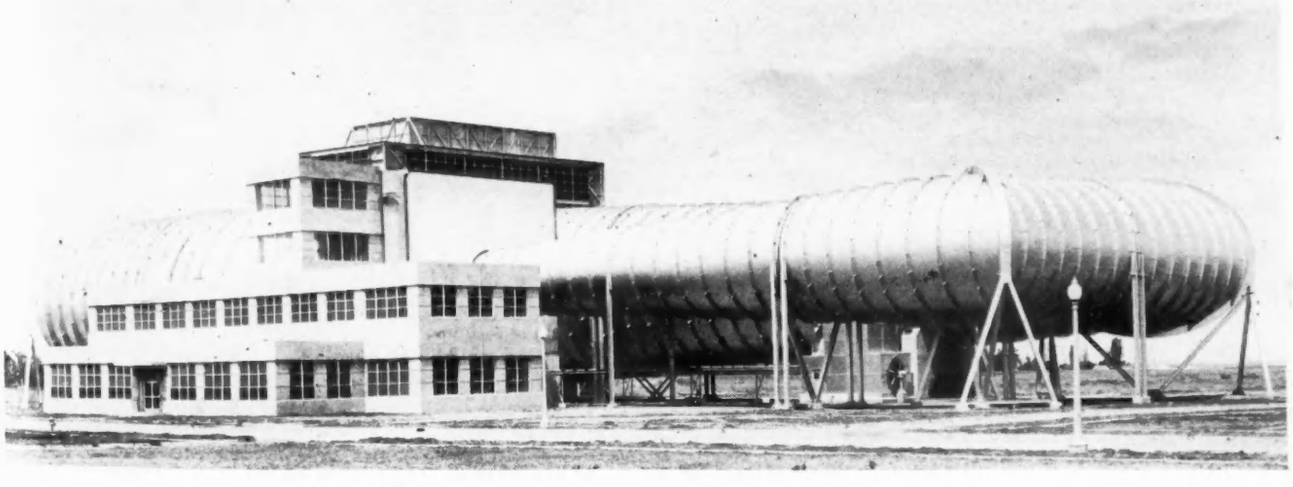
Operations at the Cleveland Aircraft Engine Research Laboratory began early in May, when the first of the 16 units which are to comprise that laboratory was opened. This $18-million laboratory will occupy a 200-acre site at the Cleveland Municipal Airport. It is expected that all of the 16 units will be in service before the end of the year.

Six major research facilities are to be provided at the Cleveland laboratory, comprising an engine-research building, an engine-research wind tunnel, a fuels-and-lubricants building, an engine-propeller research building, a flight-research hangar, and an ice tunnel. The unit already opened is the one devoted to fuels and lubricants research and, incidentally, to engine cooling problems.

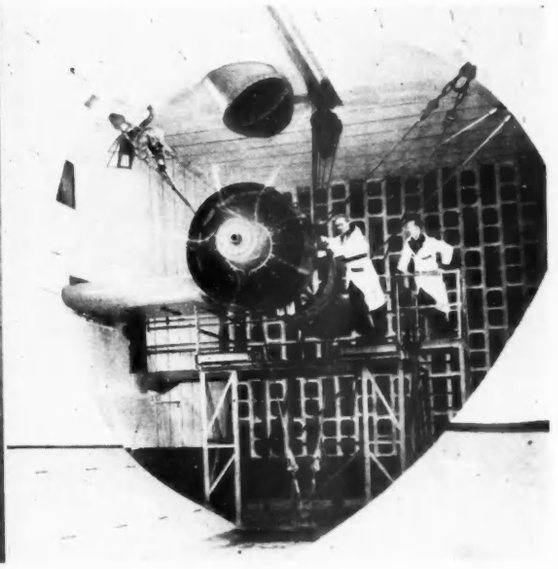
The engine research building will be equipped for investigations on both single- and multi-cylinder engines. Today there is an urgent demand for more effective superchargers, and the building will contain facilities for conducting research with the object of increasing supercharger efficiency and range. Investigations will be carried on in this building to

This photo shows the scale model of Cleveland Aircraft Engine Research Laboratory, largest of its kind in the world. John F. Victory, NACA secretary, is pointing to the engine-research wind tunnel. Ice tunnel is ahead.

New 16-ft. wind tunnel at Ames Aeronautical Laboratory, Moffett Field, Calif.



The engine-propeller research building was completed in May and was the first of the Cleveland laboratory units to be placed in operation. Dr. George W. Lewis, NACA director of aeronautical research, and NACA Secretary Victory are shown at the controls of the two torque stands in the building. The other interior view shows the test chamber.



determine the possibilities of recovering waste heat from the engines. There also will be facilities in this building for carrying out tests on carburetors, ignition systems, fuel-injection systems, etc., and special investigations of stresses on engine parts will be made there.

In the engine-research wind tunnel it will be possible to test engines under conditions simulating altitudes of up to 50,000 ft, the air temperatures running as low as 67 deg. Fahr. below zero. The air speed in the tunnel will exceed the maximum cruising speeds of any airplanes so far designed. It will be possible to test engines of up to 3000 hp.

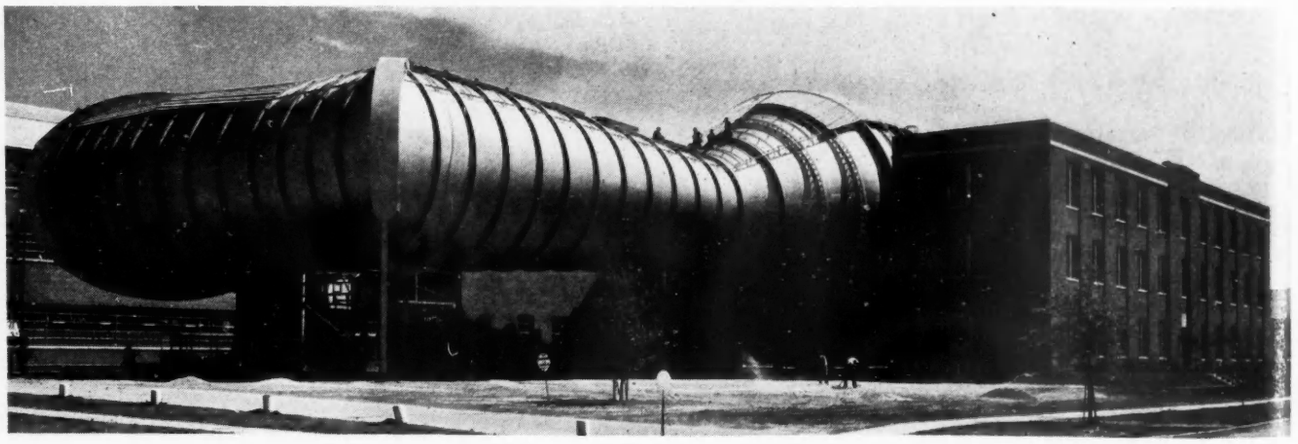
In order to attain aircraft speeds of 400-500 mph, it will be necessary to double engine output without materially increasing the size of the engines. A similar advance was achieved during the past 10 years. Investigations connected with this problem will be carried out in the third unit of the laboratory, the Fuels and Lubricants Building.

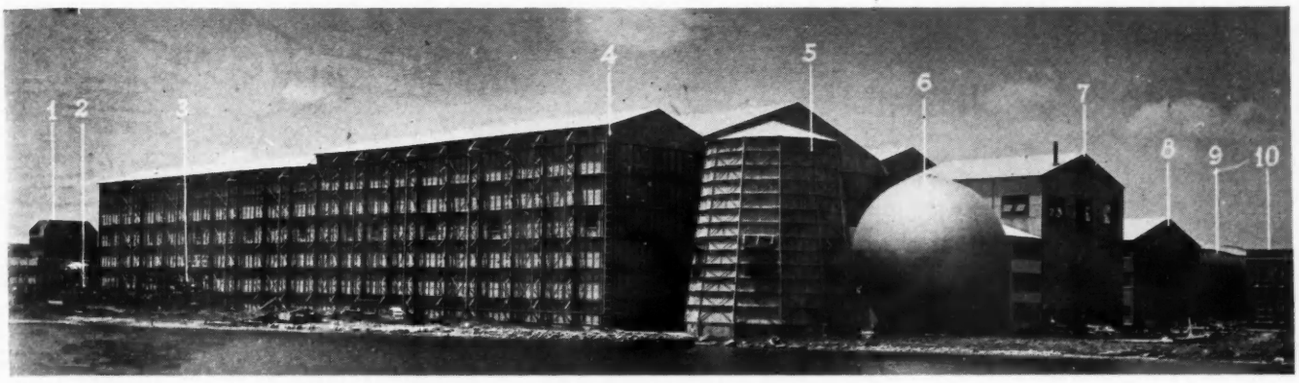
To obtain higher outputs from the engines it will be necessary to increase the cylinder charge, and to make this possible without trouble from excessive detonation, higher octane fuels will have to be used. Studies of safety fuels also will be made in this building, which will include work with fuel injection systems. Facilities will be provided for the synthesis and investigation of new and better fuels and new and better lubricants for aircraft engines.

After data on the single-cylinder and other units of the engine have been obtained, the complete engine with propeller is tested on the torque stand. Two such torque stands, which will accommodate engines of up to 4000 hp are provided in the engine-propeller research building. These torque stands will be used for lubricating-oil research in full-scale engines, to correlate the data which are obtained in single-cylinder tests throughout the country, under a cooperative program. The torque stands also will be used to determine some of the ground conditions affecting supercharging, cooling and vibration of aircraft engines. Studies will be made of the stresses in various engine parts. Such research is of the highest importance at the present time when the object is to obtain greatly increased outputs from engines of a given size. This will be possible only if excessive stresses are eliminated and materials are developed which will withstand higher stresses.

All results obtained in single-cylinder and multi-cylinder engine tests must be finally checked in flight. In the flight-research hangar airplanes will be

NACA 19-ft pressure wind tunnel at Langley Field.





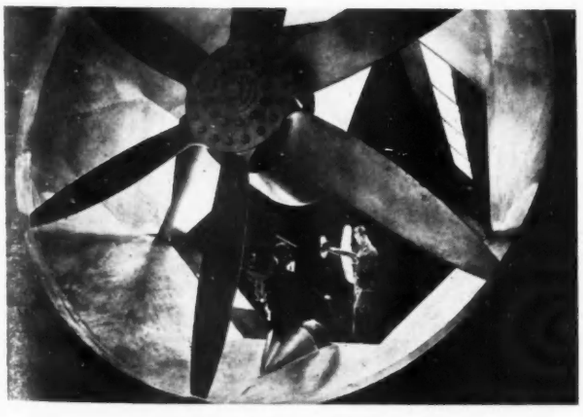
Sky line view of the Langley Memorial Aeronautic Laboratory at Langley Field, Va.

(1) 8-ft high-speed wind tunnel; **(2)** vacuum-testing sphere; **(3)** electric substation; **(4)** full-scale wind tunnel; **(5)** 20-ft free-spinning wind tunnel; **(6)** 12-ft free-flight wind tunnel; **(7)** 15-ft free-spinning wind tunnel; **(8)** technical service building; **(9)** 19-ft pressure wind tunnel; **(10)** NACA tank office building.

equipped with instruments and special flight-testing equipment for flight investigations to check laboratory data.

The ice tunnel will be a refrigerated wind tunnel in which investigations of ice formation on windshields, propeller blades, cooling ducts, carburetor intake manifolds, wings, and various other parts of the airplane will be made. Extremely low temperatures will be obtainable in this tunnel, which will make use of the powerful refrigerating equipment of the engine-research wind tunnel.

During the past year new wind tunnels were placed in service at Langley and Moffett Fields, representing an expansion of more than 100 per cent in the facilities of this kind devoted to urgent defense problems, and additional wind tunnels now under construction



Test section of NACA 12-ft free-flight wind tunnel.

will, upon completion, add another 100 per cent to the facilities available a year ago.

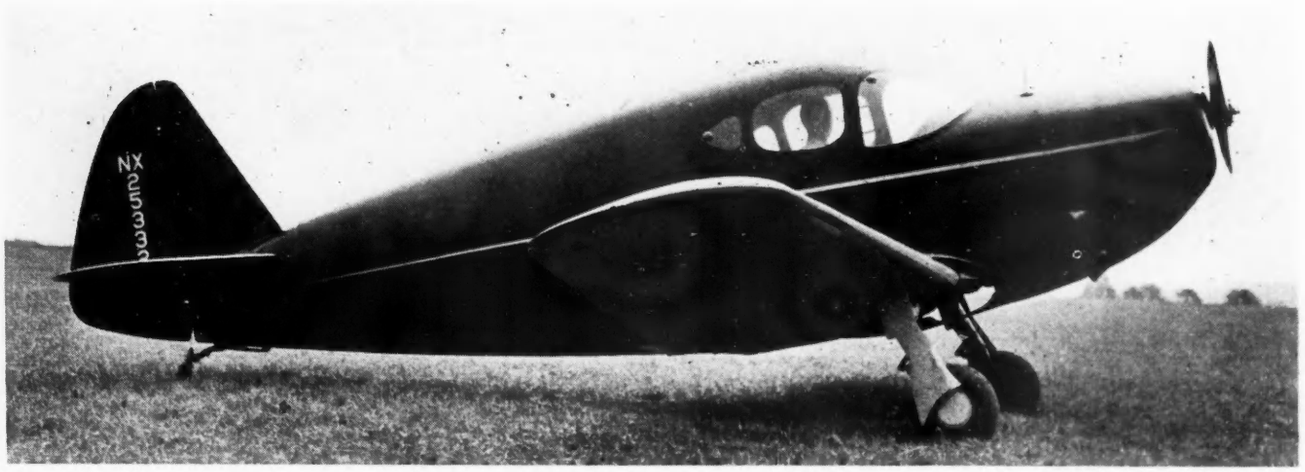
Constantly increased performance is demanded of military aircraft, and there is need for much fundamental and specialized research to solve problems relating to the desired characteristics of naval and military types of aircraft provided for in the war program. The outstanding fighter types of the European warring nations during 1940 and 1941 had maximum speeds of the order of 360 mph. The NACA points out that the American aircraft program for 1942-3 must provide new fighters of much higher speed—400 m.p.h., and as much more as is practicable. It was necessary to develop a new wing section of the low-drag type; to obtain accurate data in a low-turbulence wind tunnel of its lift and drag, to determine the effects of various types of flaps for increasing lift, and the action of normal and other lateral control devices. It was necessary also to re-examine the method of cowling and cooling both air-cooled and liquid-cooled engines at high air speeds. Special cowlings were required to handle the air needed to cool the engine, the oil radiator, the inter-cooler and—in the liquid-cooled type—the radiator. This work was based on theoretical analysis and proved in wind-tunnel and flight tests.

New propeller-blade sections and new plan forms for the blades had to be developed for extreme speeds, so as to keep the losses under these conditions down to a minimum. At high speeds the airplane is subject to "compressibility effects." The wing, the fuselage, the propeller, and other parts must be designed to eliminate compression waves as far as possible, which necessitates tests in a high-speed wind tunnel.

Modern military planes must be able to operate at high altitudes. This requirement calls for better supercharger equipment and better engine-cooling facilities, and at very high altitudes an intercooler is needed. In the development of new military airplanes it is necessary to determine the spinning characteristics by special model tests. Where the design is of a radically new type, tests are also made in the free-flight tunnel, to make sure that its stability and control are adequate.

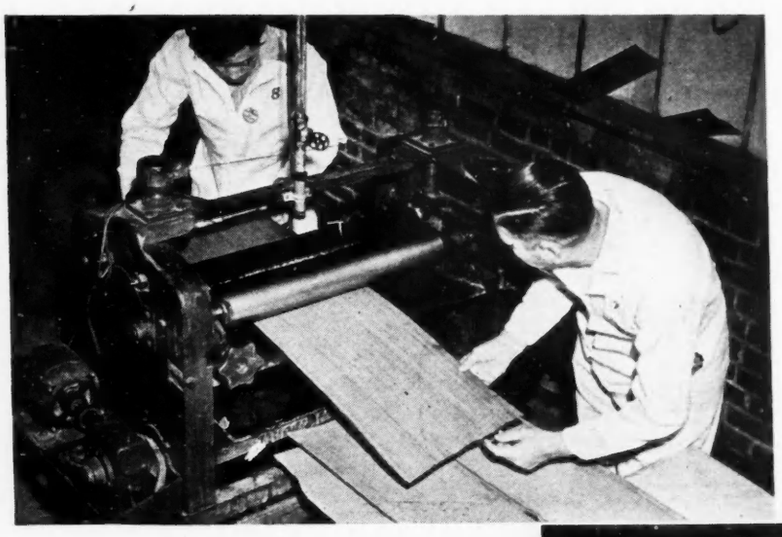
During the past year seven new wind tunnels and a structures-research laboratory were placed in operation by the NACA, and all are now engaged on problems connected with the war program. The new wind tunnels at Langley Field include a 20-ft free-spinning tunnel, a two-dimensional tunnel, a stability tunnel with two interchangeable throats that are used to simulate either straight or curved flow conditions, and a 16-ft high-speed tunnel. Already in operation at

(*Turn to page* 64, *please*)



All-wood veneer plastic plane developed by the Vidal Research Corp.

Plywood Planes by the V



A NEW process for the manufacture of aircraft and other parts from plastic-bonded plywood has been developed by the Vidal Research Corp., Camden Airport, Camden, N. J. The inventor of the process (on which a U. S. patent was issued on March 12 last) is Eugene Vidal, who has long been connected with the aircraft industry and who from 1933 to 1937 was director of aeronautics, Department of Commerce.

In the Vidal process use is made of wooden forms or molds on which a shell of plywood veneer is built up. In

Strips of wood veneer are run through this machine to saturate them with glue.

Stapling the sheets of veneer to a fuselage mold.

By P. M. Heldt

Vidal Process

such parts as aircraft fuselages, for instance, which are molded in halves, three successive layers of veneer are applied to the form with the grain of the wood running in different directions. Grooves or slots are cut in the form where ribs or stiffeners are required, and these parts, also built up of plywood, are set into them. As each strip of plywood is put in place on the mold it is secured by means of staples. When the article to be molded is thus completely built up, it is enclosed in an air-tight bag, from which the air is then exhausted by means of an air pump, with the result that the treated fabric of the bag is applied to the plywood structure with uniform pressure. The bag with its contents is then placed in an autoclave in which it is subjected to heat and pressure for a definite length of time. This softens the plastic and welds all parts of the structure into a single mass.

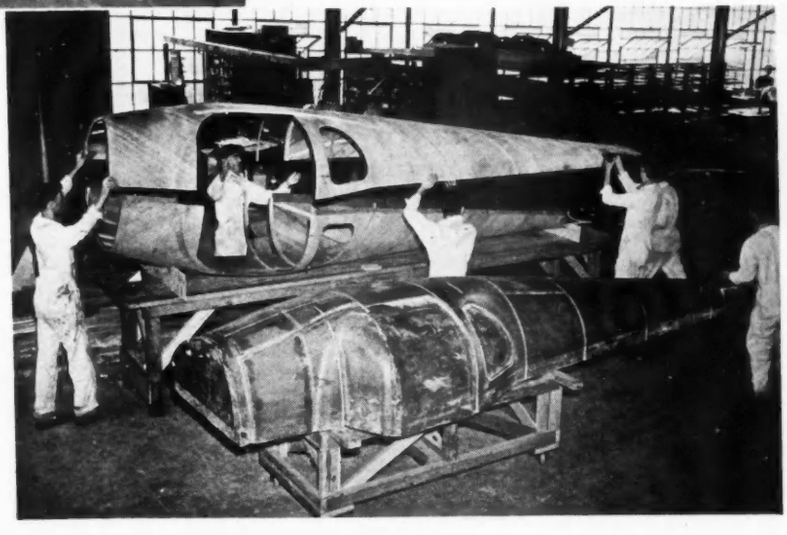
It is natural that in the development of this process a number of problems had to be solved. At first hard wood was used for the molds, but it was found that this gave trouble from swelling and distorting under the effects of moisture and heat to which the mold is subjected during the curing or "cooking" process. This problem was solved by making the molds of soft woods. Considerable trouble was experienced also in the early stages of the development from cracking and tearing of the bags, which were then made of rubberized fabrics. At present the bags are made from a special material developed by the DuPont firm, and we understand that the latter sells these under the name of Vidal bags.

In the autoclave the bag is subjected to a temperature of about 240 deg. F. and a pressure ranging from 20 psi. upward. One difference between this method of molding and pressing of sheet metal between upper and lower dies is that the pressure is uniformly distributed over the entire surface, whereas if two rigid dies were used the pressure would be very uneven. This evidently would be undesirable with plywood, which does not possess the same flow characteristics as the soft sheet metals formed in the press.

Evacuating the air from the bag also proved a problem, and when Mr. Vidal and his engineer finally hit upon a method which they thought would solve it, they found it had al-

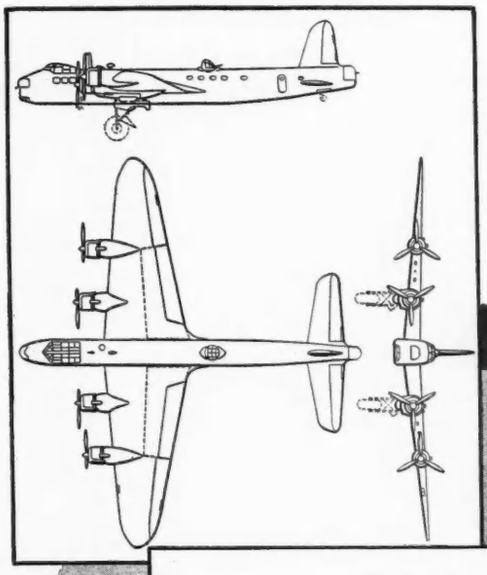
(*Turn to page* 68, *please*)

After the layers of veneer have been stapled to the mold, the entire form is placed in an autoclave equipped with a bag of special material to withstand the heat and pressure.

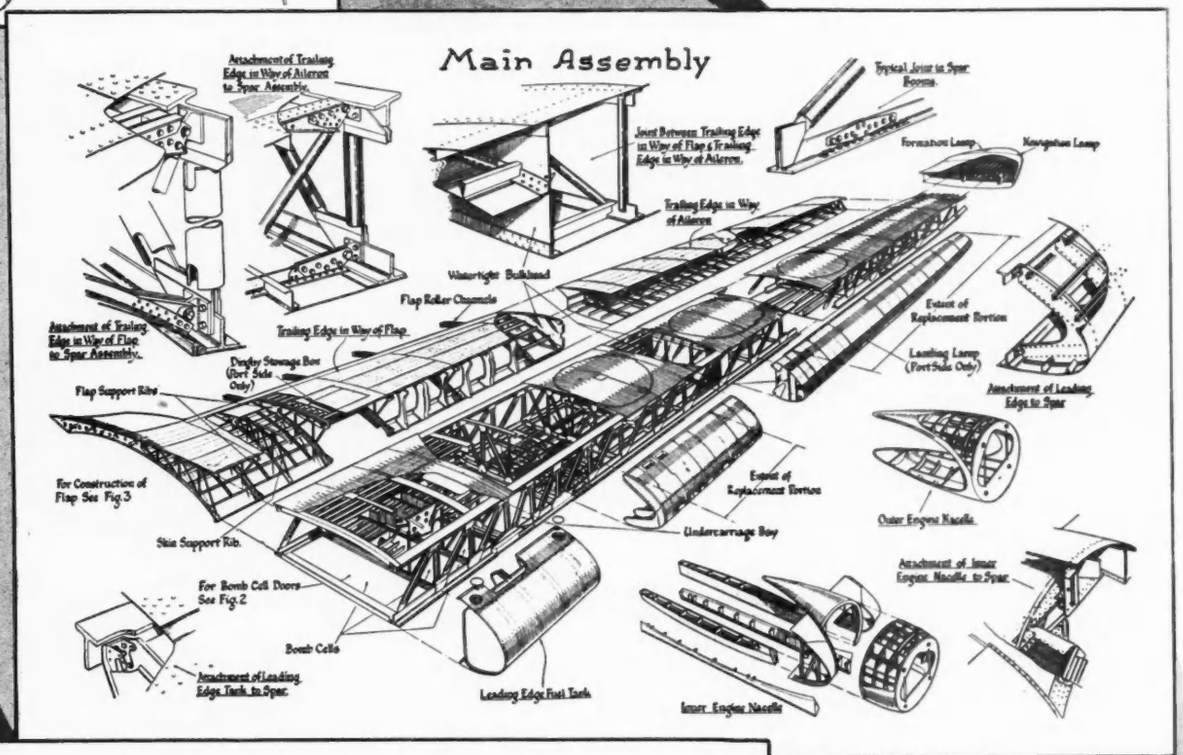


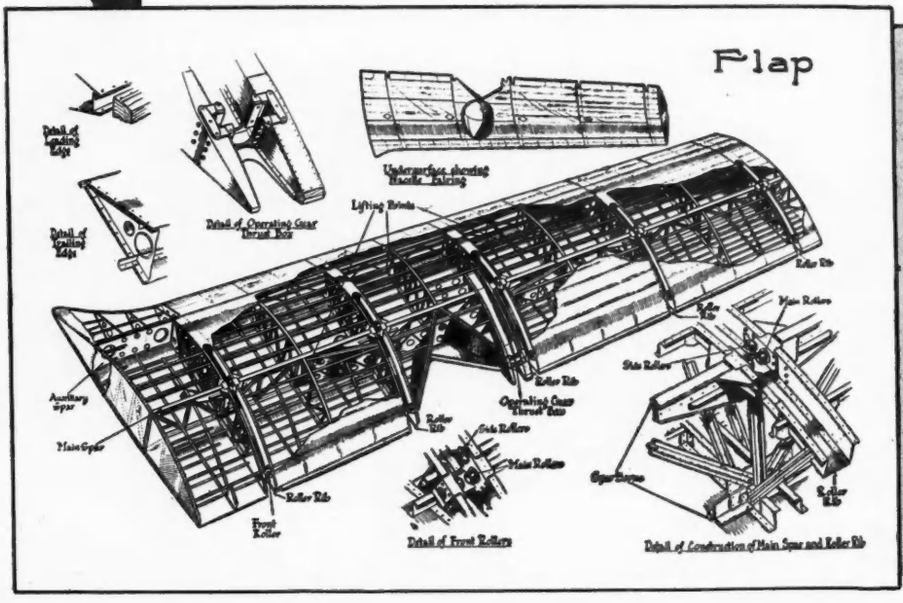
Fuselage halves are welded together without the use of metal.

The Short S



ON THIS and the following pages will be found constructional details of Britain's mighty Short Stirling bomber. Carrying a bomb load of "up to 8 tons," the plane is powered by four 1600-hp single-sleeve-valve Bristol "Hercules" engines. A full description of the Stirling was published in the April 15, 1942 issue of AUTOMOTIVE *and* AVIATION INDUSTRIES.


Main Assembly
Attachment of Trailing Edge in Way of Aileron to Spar Assembly.
Typical Joint in Spar Booms.
Joint Between Trailing Edge in Way of Flap & Trailing Edge in Way of Aileron.
Formation Lamp
Navigation Lamp
Trailing Edge in Way of Aileron
Wheeltight Bulkhead
Flap Roller Channels
Attachment of Trailing Edge in Way of Flap to Spar Assembly.
Trailing Edge in Way of Flap
Dinghy Stowage Box (Port Side Only)
Extent of Replacement Portion
Landing Lamp (Port Side Only)
Attachment of Leading Edge to Spar
Flap Support Ribs
For Construction of Flap See Fig. 3
Extent of Replacement Portion
Outer Engine Nacelle
Undercarriage Bay
Skin Support Rib.
Attachment of Inner Engine Nacelle to Spar
For Bomb Cell Doors See Fig. 2
Bomb Cells
Attachment of Leading Edge Tank to Spar
Leading Edge Fuel Tank
Inner Engine Nacelle



Stirling Heavy Bomber

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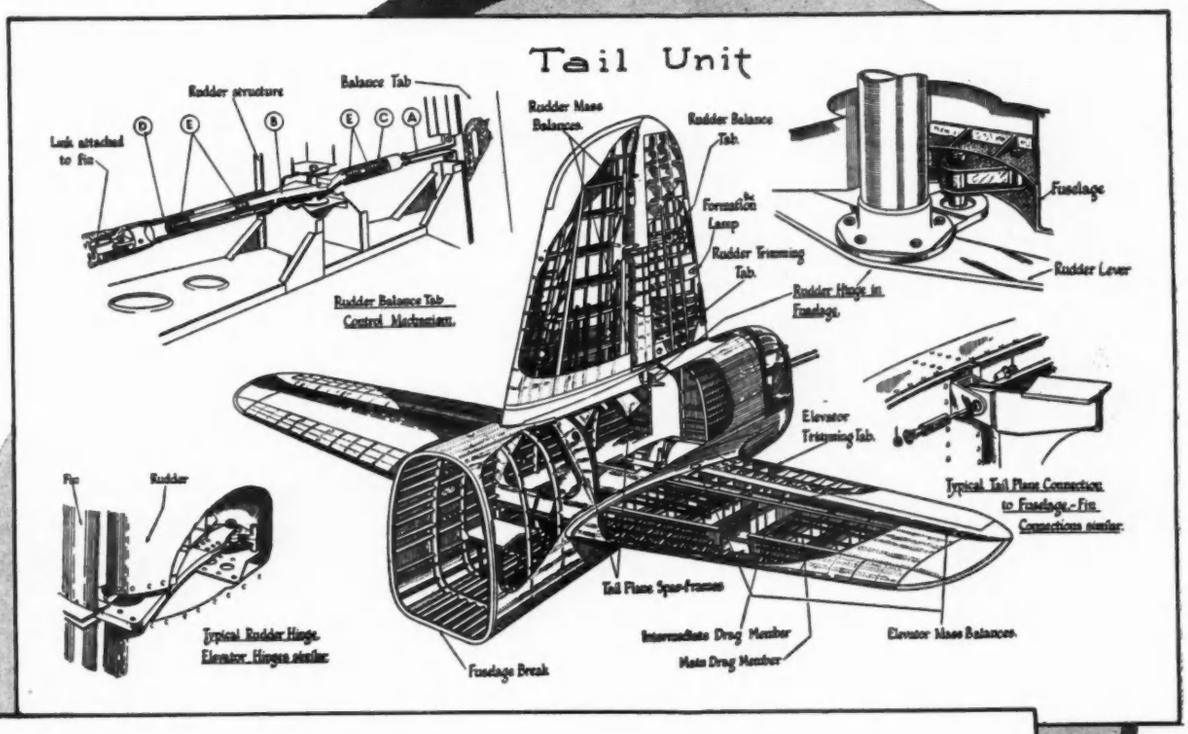
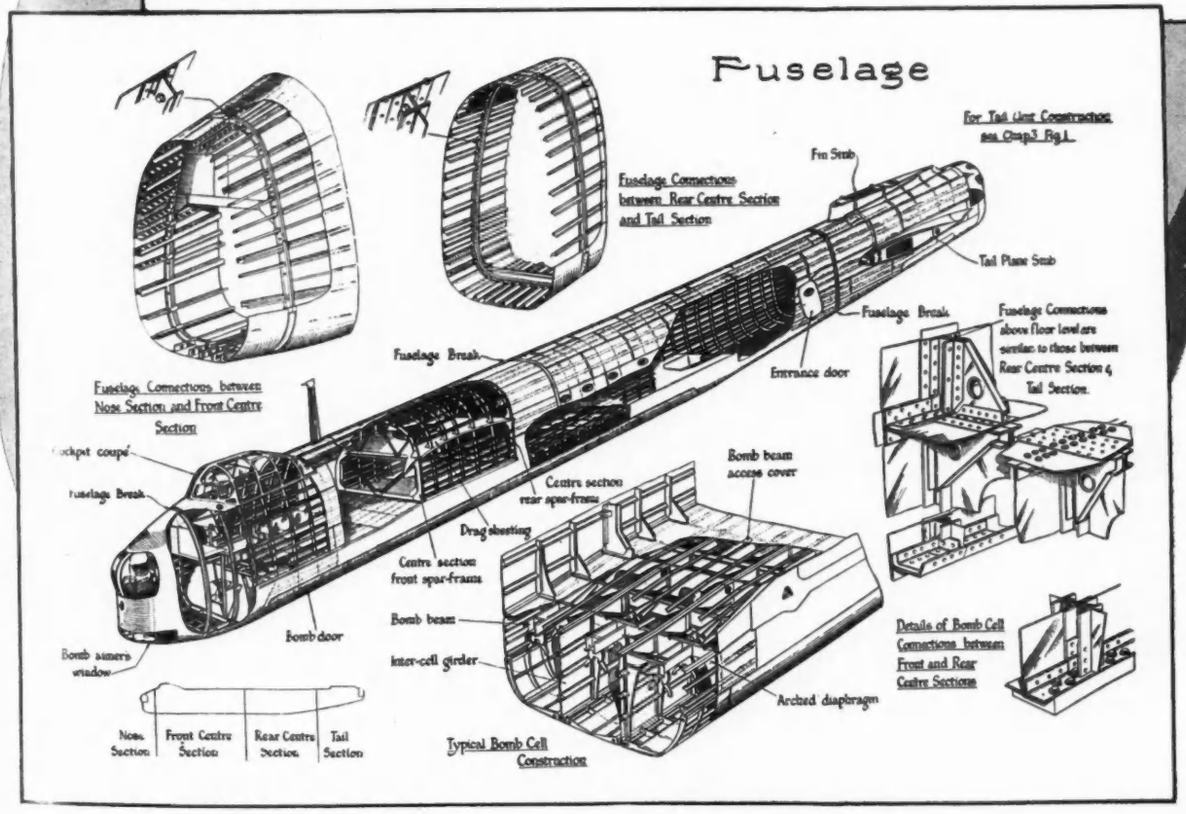
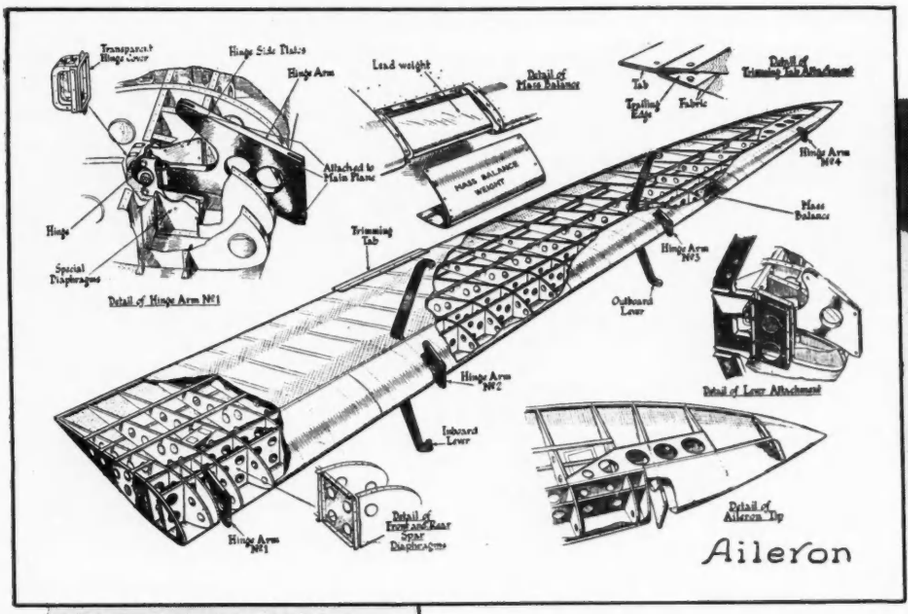
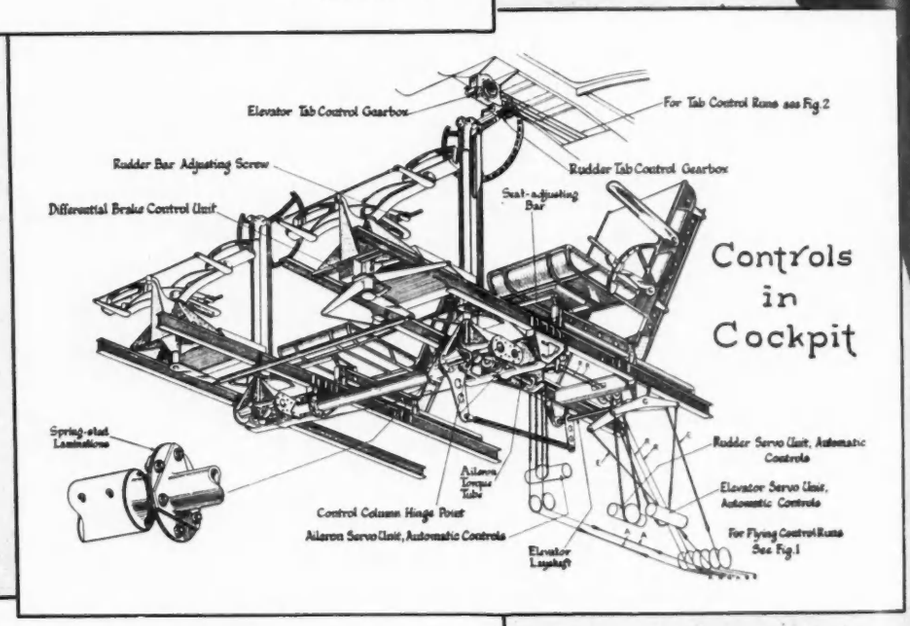


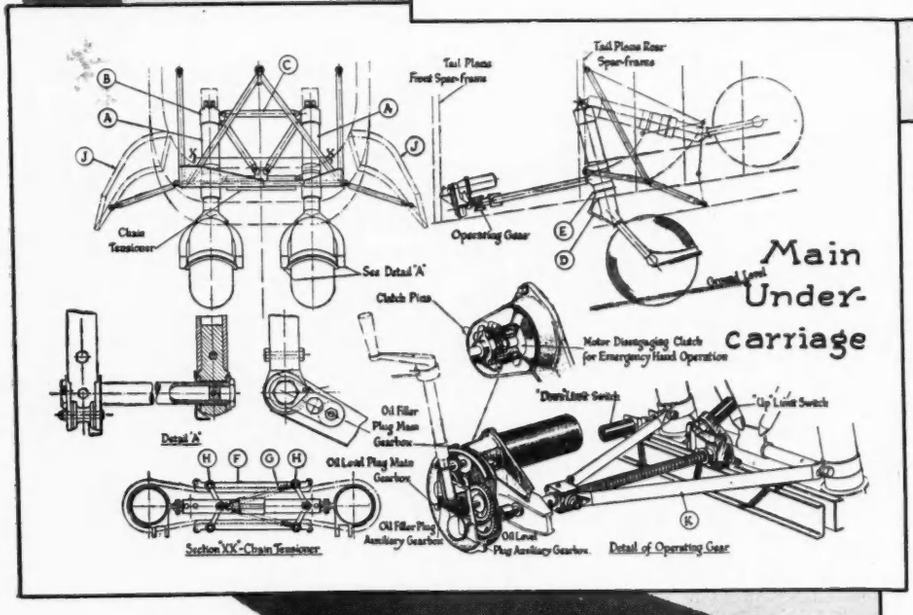

Fuselage
For Tail Unit Construction see Chap.3 Fig.1
Fin Stub
Fuselage Connections between Rear Centre Section and Tail Section
Tail Plane Stub
Fuselage Break
Fuselage Connections above floor level are similar to those between Rear Centre Section & Tail Section.
Fuselage Break
Entrance door
Fuselage Connections between Nose Section and Front Centre Section
Cockpit coupé
Fuselage Break
Centre section rear spar-frame
Bomb beam access cover
Drag sheeting
Centre section front spar-frame
Bomb beam
Inter-cell girder
Bomb door
Bomb aimer's window
Arched diaphragm
Details of Bomb Cell Connections between Front and Rear Centre Sections
Nose Section
Front Centre Section
Rear Centre Section
Tail Section
Typical Bomb Cell Construction

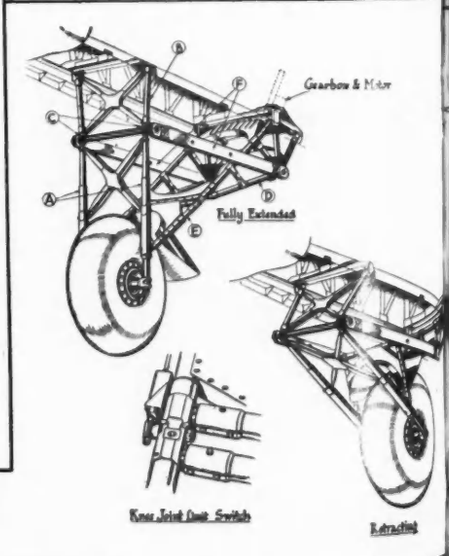
SHORT STIRLING

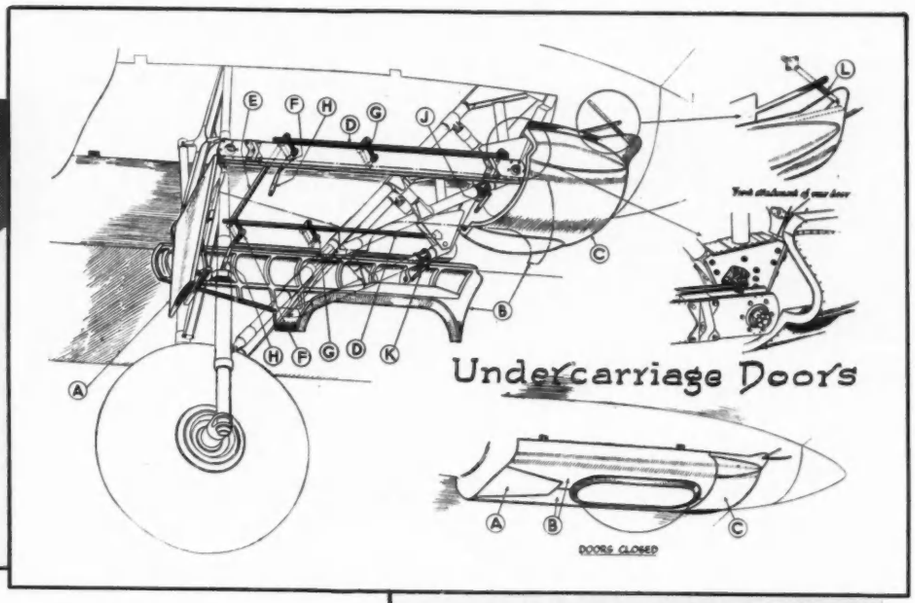
Continued from the

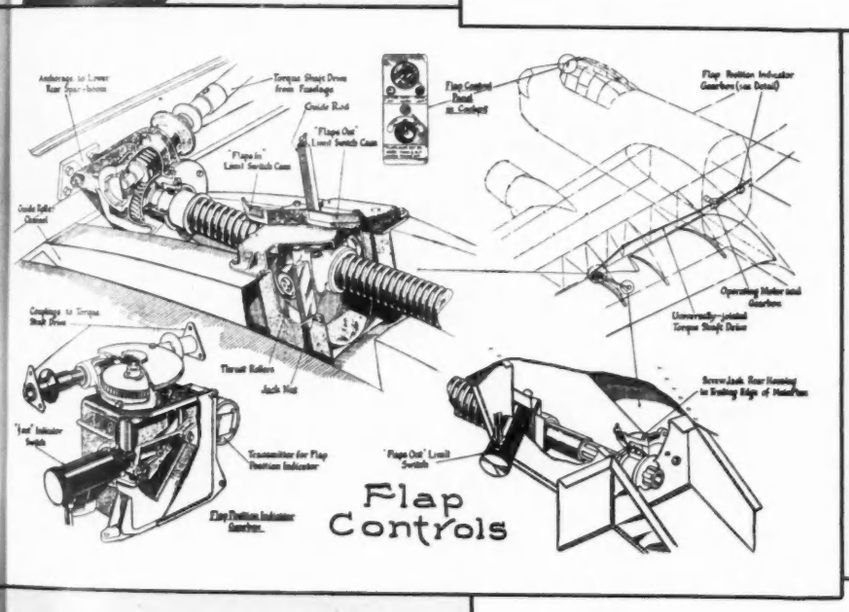


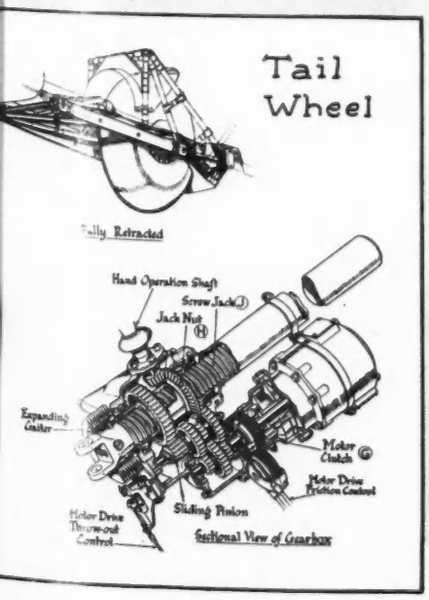


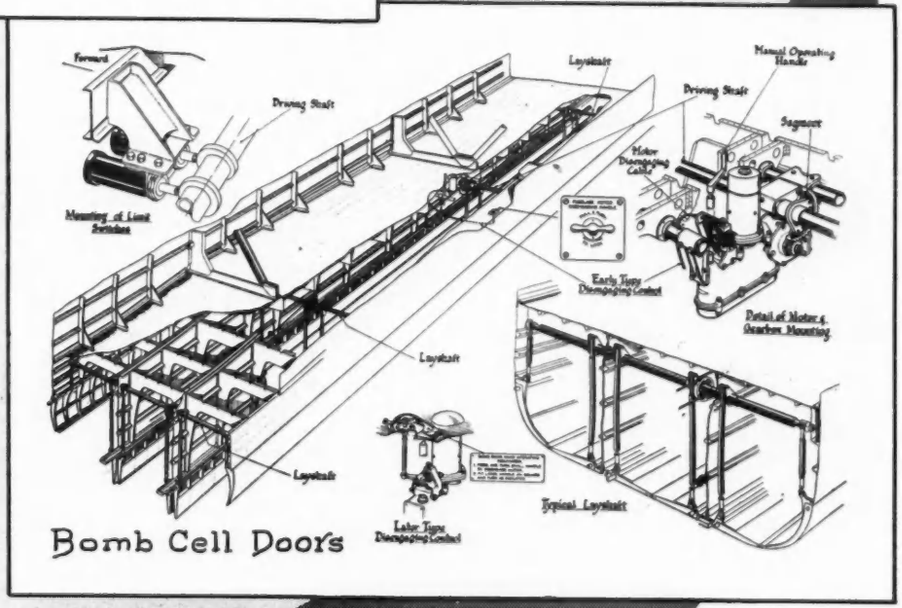




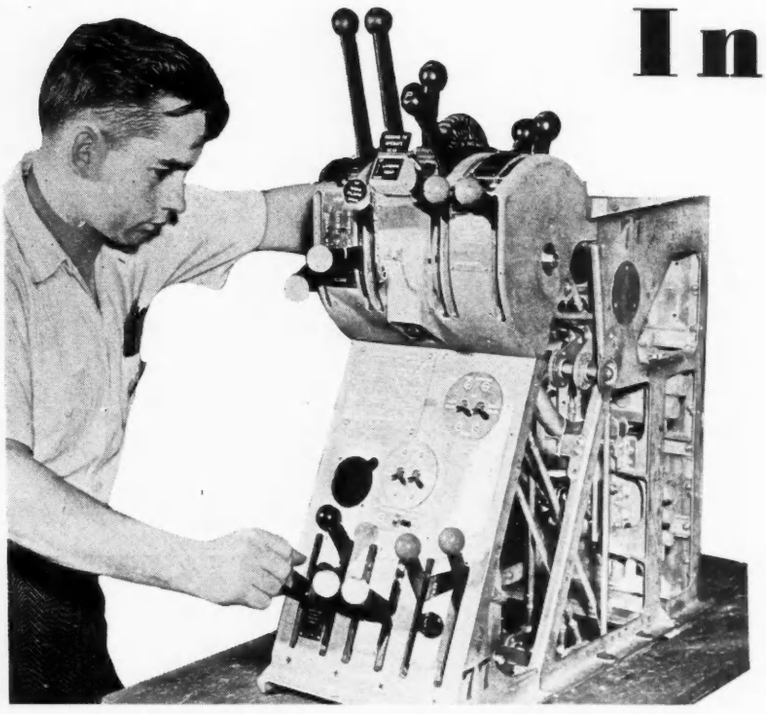

Undercarriage Doors
DOORS CLOSED


Flap Controls


Tail Wheel
Fully Retracted
Sectional View of Gearbox

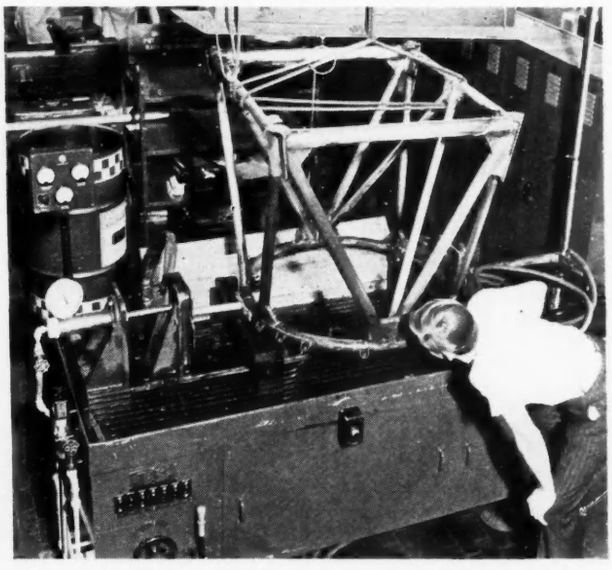

Bomb Cell Doors

Inspecting M



Controls are run through their operating sequence to make certain clearances are adequate.

SO IMPORTANT is the inspector in the modern aircraft plant that he has become the guarantor of manufacturing standards and the symbol of airworthiness. At the Glenn L. Martin Co. approximately 2000 highly trained technicians have this responsibility. On a B-26 medium bomber the inspection involves scrutinizing 25,000 parts and the joints formed by 300,000 or so rivets. This series of photographs show some of the many inspection operations at the Martin plants.

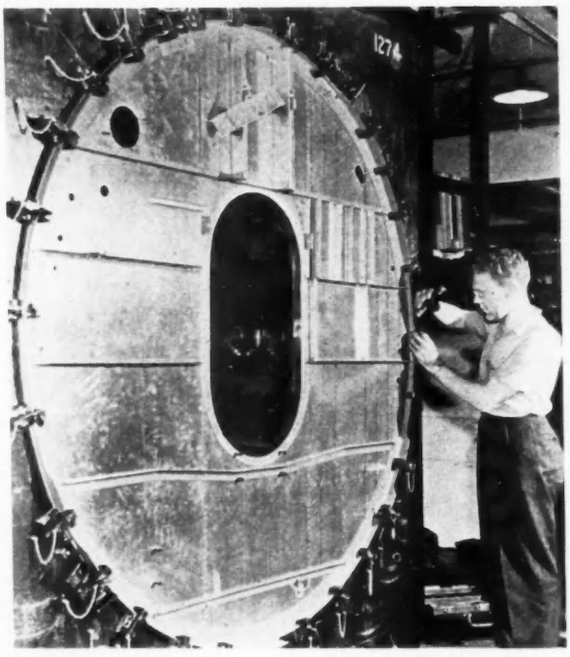


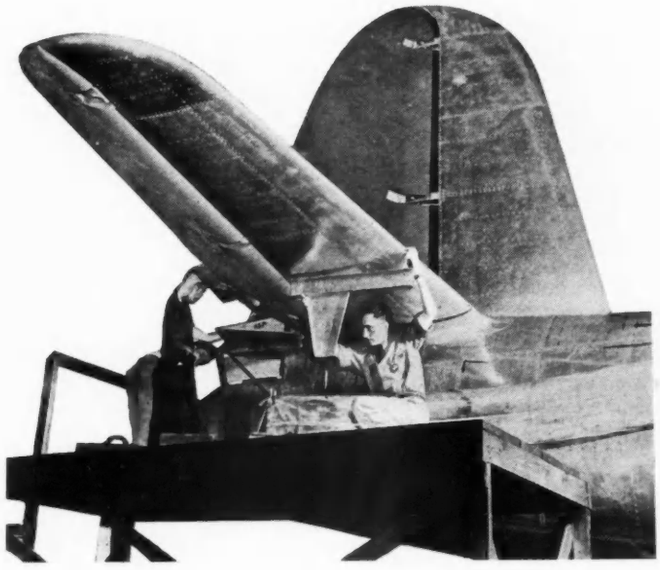
(Above) Highly stressed 80-lb. engine mounts which are made of welded chrome-molybdenum steel tubing and support over a ton of engine against power dive and landing loads, must pass this electromagnetic inspection, which will reveal cracks that would have to be magnified 50 times to make them visible to the naked eye.

(Right) It is the inspector's touch with the feeler gage upon which depends the certainity that this forward landing gear strut locks precisely in the right position when the tremendous landing loads take place.

Martin Bombers

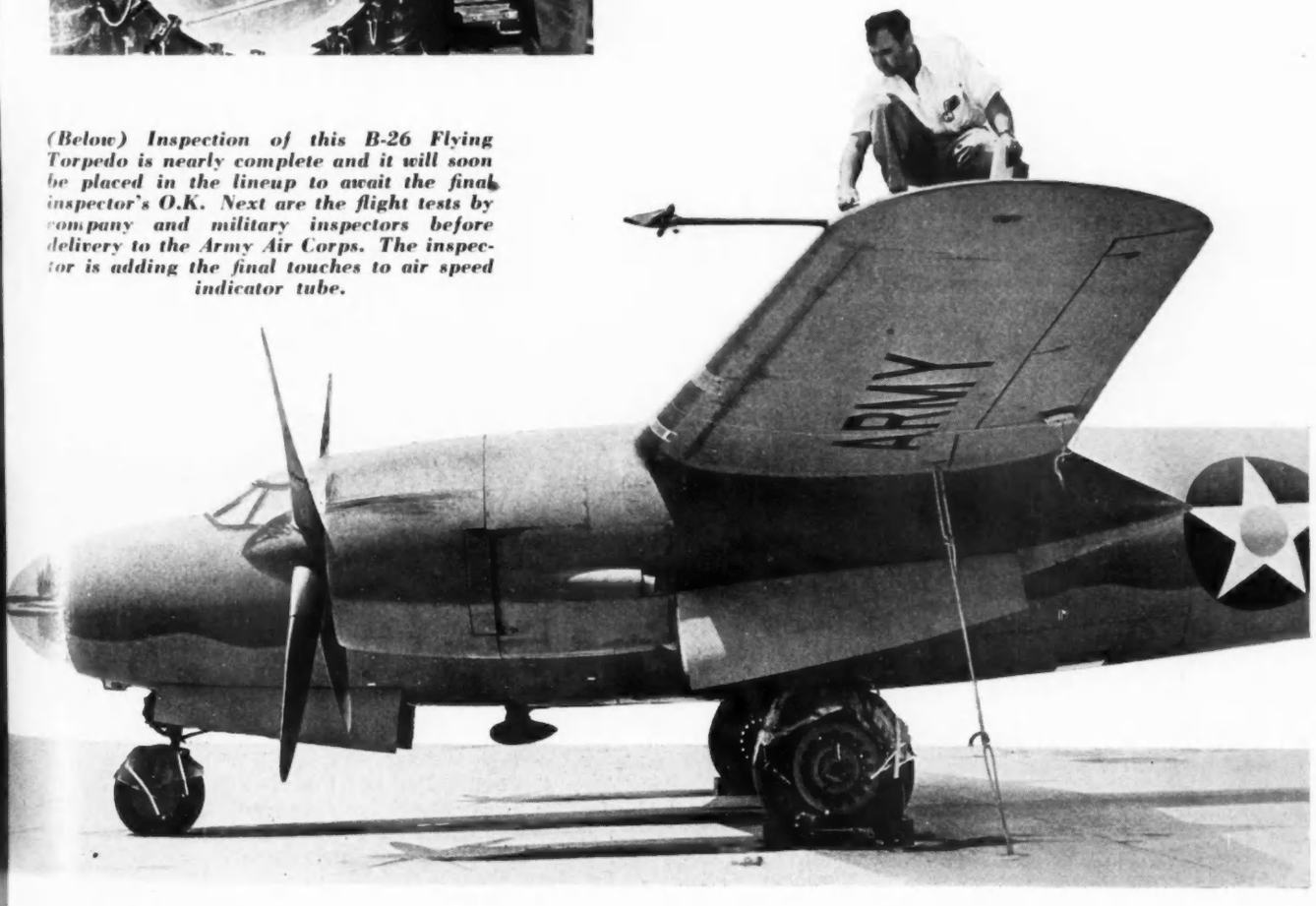
(Below) Bulkheads, like many other parts, are checked thoroughly to assure alignment of holes with mating parts.





Tail control surfaces must be set precisely in relation to the fuselage. A special tool is used to verify the incidence of the stabilizer.

(Below) Inspection of this B-26 Flying Torpedo is nearly complete and it will soon be placed in the lineup to await the final inspector's O.K. Next are the flight tests by company and military inspectors before delivery to the Army Air Corps. The inspector is adding the final touches to air speed indicator tube.



Airbriefs

By HENRY LOWE BROWNBACK

Forged Cylinder Heads

For some years the British have been forging the aluminum alloy cylinder heads as well as the pistons of their aircooled aircraft engines. This compels them to machine out the cooling fins and some other parts which makes a most complicated and expensive manufacturing set-up. The Wright Aeronautical Corp. has now adopted this same procedure with a different production method which starts with an extruded blank pressed in a die to final shape. The extrusion-die process eliminates 9 drop hammer operations which would be necessary with a forged head. The fins are cut on high speed milling machines permitting closer finning than was possible with the old cast head.

The Wright company claims that the new head saves material and manhours through a 40 per cent saving in material rejections. A 12 to 15 per cent increase in power is made possible by closer spacing of fins and a 35 per cent increase in the conductivity of the metal in the heads gives higher bmep. Again metallurgy and manufacture step in to permit the engineer to better his product. In fact, the whole secret of the progress of the automobile and the aviation industries has been the close cooperation between the inventor, the engineer, the production men, the chemist and the metallurgist and no small credit for this must go to the great engineering society which has done so much to foster it and to the technical press which has acted as a clearing house for information.

Early Birds

If you were to ask the average man who was the first person to advocate the use of aircraft as troop carriers to drop men behind the enemy lines he would say Billy Mitchell. He wasn't. It was proposed to Louis XVI in France as a possible means of invading England and Benjamin Franklin was so impressed with the idea that he wrote a full report of it to the Continental Congress and strongly advised that it be tried. The first proposed bombing was that of the Toulouse, which had stayed loyal during the French Revolution.

Napoleon used aircraft for observation at the battle of Fleurus, but was turned against balloons because of an accident which occurred during one of his military celebrations and the first really scientific use of aircraft was done in this country by T. S. C. Lowe during the Civil War when messages were sent during several thousands of ascensions and the system of getting distances to enemy points by altimeter triangulation developed. At this time the first portable balloon hydrogen generators were invented and built and the first use of military aircraft from a boat—the George Washington Custis. The relics of this early endeavor are to be seen at the Smithsonian Institution at Washington as are many other things of interest gathered there by the capable hands of Paul Garber.

Old Timers

We are sometimes led to believe that modern aircraft are the first to embody many devices widely heralded as new, but—the Antoinette in or about 1909 had a 16-cylinder "Vee" type steam cooled engine, direct-fuel injection, an all metal propeller, a boat-form all wood fuselage and a thick semi-cantilever wing, then the Deperdussin which first made 120 mph—somewhere about 1910—had a monocoque fuselage, a cowled 14-cylinder aircooled engine with direct-fuel injection and in 1922 the Bristol racer embodied in a low wing monoplane and such modern items as a 450 hp radial engine, full retractable landing gear, monocoque fuselage, fully cowled engine and wing root-fillets.

Where to the Radial?

About the easiest way to get into an argument in the airplane industry is to start to compare the radial and the "in line" engine. As a strong exponent of the radial engine and having been associated with the father of the aircooled radial, Mr. Anzani, your columnist, has often been right in the middle of such thunder storms. The first really light weight gasoline engine was a radial designed and built for one of Dr. Langley's "Airdromes" and it was a remarkable job—5 cylinders, water cooled, with slipper type connecting rods and weighing about 2 lb per hp.—a veritable feather compared to the first Curtiss and Wright engines.

The first radials to fly were the rotary engines and the first static radial was the Anzani made in one, two and four rows from 3 to 20 cylinders. The radial construction represented the most economical use of material, so the early radials were lighter than the "line" engines and as they were simply hung out in the open in the nose of the airplane they were easy to service.

As powers rose the aircooled radial engine presented cooling problems which were met by cowlings which were simple at first and when they became more and more complicated until today they are one of the major design and installation problems of the radial. In fact the liquid cooled in-line engines used in fighting planes can be changed or serviced far faster today than the aircooled with its complicated cowling.

In the early days the aircooled radial presented distribution problems which were met, first by multiple manifolds, one being a 3-way corkscrew type, then by slow speed impellers built into the induction system. Simply redesigning these impellers and speeding them up made simple and reasonably efficient superchargers.

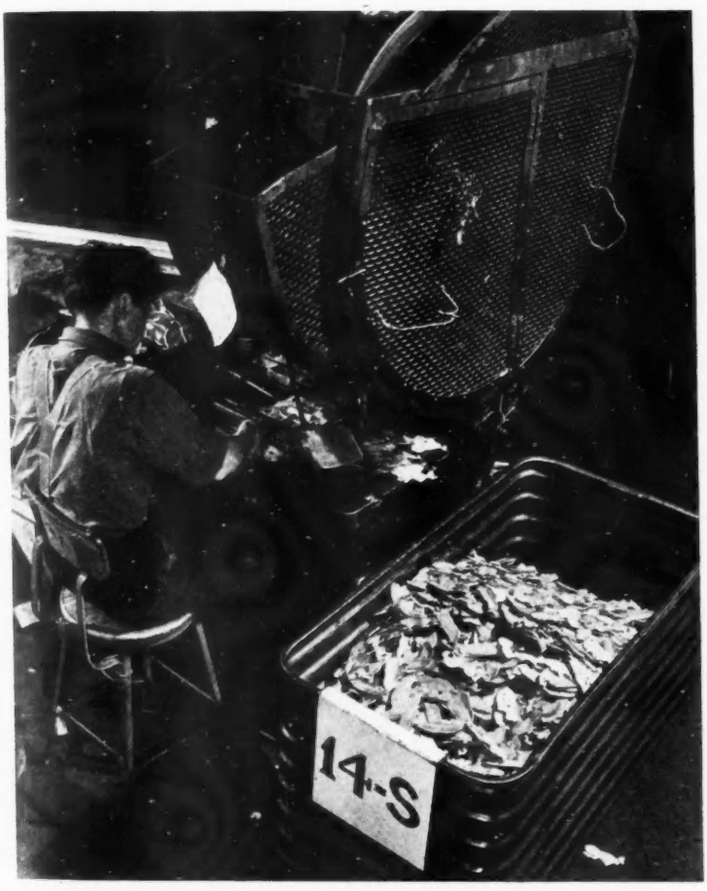
The original radials were simple—one cam per cylinder driven by a simple crankshaft gear while a second pinion drove the magneto. Then came dual ignition, double or triple oil pumps, vacuum pumps, generator and starter drives, deicer pulsator drives — all plastered on the accessory drive housing of the poor radial until the life-sized engine had to be built as a mock-up and all of this worked out on the model before the final design could be made. Even with all of this the radial aircooled engine still powers our large seaplanes, bombers and transports and many of our fighting planes, to say nothing of tanks and other implements of war. Those of us who pioneered this development can smile with pride and extend all possible felicitations to the men who have brought the modern large radial to its present point of perfection. My only thought is that the plane builder of today should imitate the shipbuilder and put all possible auxiliaries on auxiliary engines. Can you imagine a ship's engine room in which the vacuum pumps, generators, bilge pumps, sanitary pumps, oil pumps and the mass of other little drives were hung on the main turbines driven by gears of every type running at all sorts of angles? I can't.

A New Airliner

The Lockheed "Constellation" will make the coast-to-coast run in 8½ hours, have a capacity of 64 persons or more than 16 tons net load, a top speed of 350 mph, range of more than 4000 miles and low altitude comfort up to 30,000 ft. The Army is getting a fleet of shot-welded stainless steel cargo carriers of large capacity. Yes, aviation is shedding its swaddling clothes!

Complete Segregation Necessary in Getting the Most out of

Aluminum Scrap



Segregation begins at the machine with the scrap box clearly marked.

AMERICAN industry's big push to provide all the aluminum needed in the victory program is getting vital help through the back door. Experts say that, with the full cooperation of every manufacturer who uses aluminum, the amount of segregated scrap that can be made available for reprocessing into first-grade sheet this year would supply 15 to 20 per cent of the total sheet demand.

That word "segregated" is important. Once aluminum scrap is contaminated with other metals, or even with other aluminum alloys, it is extremely difficult to reprocess it into specific commercial alloys again. Proper segregation is the right answer to the problem of getting the most from aluminum scrap, for then by using the correct techniques, the aluminum scrap can be reprocessed into new metal the equal of the original. A good segregation system is amazingly simple if a few primary rules are observed in setting it up.

A thorough system of supervision and checks on scrap-handling in the plant will pay big dividends. Some large manufacturers have set up reprocessing departments of their own, and know the value of a definite, rigid scrap segregation program. But any plant handling aluminum can, with similar care in keeping scrap carefully separated and identified, achieve amazing economies, too.

Scrap Bugaboos

Probably the most deceiving enemy of clean scrap is stainless steel. Its appearance and that of aluminum are almost identical, so unless great care is taken, it may creep in unnoticed and raise the iron content of a batch of scrap to such a degree as to make it almost useless for reprocessing into anything better than second-grade material.

Segregation of aluminum scrap from other metals is not enough in itself, and a particular aluminum alloy must be kept separate from all other types of aluminum scrap. The characteristics of each aluminum alloy depend on small proportions of alloying elements being added in exact quantities to the basic aluminum and these alloying materials vary in both quantity and character with the different alloys.

The make-up of alloy 24S for instance, includes 4.5 copper, 1.5 magnesium, and 0.6 manganese. On the other hand, alloy 52S contains 2.5 magnesium and 0.25 chromium. Mix these alloys together in the form of scrap and the characteristics of both alloys are lost. Moreover, the chromium content of the 52S is wasted. And, of course, chromium is scarce enough these days to make such a loss quite a considerable item in view of the amounts of aluminum scrap being produced.

Planning the Program

One of the important ways to start a scrap segregation program is through training of personnel. New men, first of all, should be carefully instructed in the necessity of maintaining the identity of scrap alloys. When mix-ups are discovered, every effort

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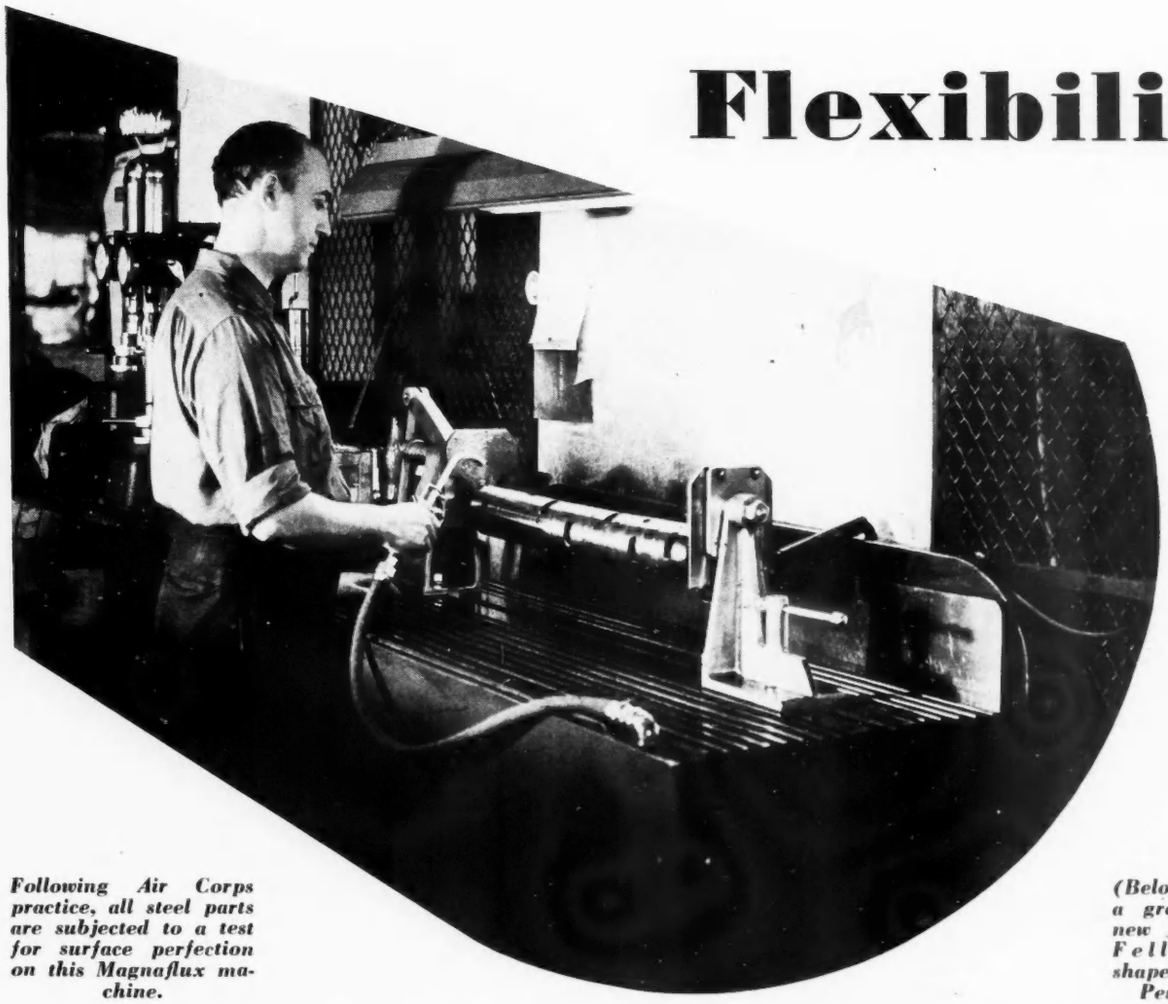
Flexibility



Following Air Corps practice, all steel parts are subjected to a test for surface perfection on this Magnaflux machine.

(Below) One of a group of the new High Speed Fellows gear shapers in the Pesco plant.

By Joseph Geschelin

FUEL pumps, gear pumps, vacuum pumps, valves, and hydraulic cylinders of many types—these are the products now being turned out in great volume for military airplanes, for tanks, and for marine engines by the Pump Engineering Service Corp. Since the Pesco plant was acquired by Borg-Warner Corp., some time ago, it has been completely reorganized as to management and placed on a rational production basis. Due to the accelerating war program the demand for the specialties made by this organization has attained values exceeding many times the capacity heretofore and has made it necessary to expand manufacturing facilities into three widely separated plants.

Despite the great unit volume of the product, the variations in design are so marked as to make the manufacturing operation one of job-lot rather than of volume production. Some comment on the setting will make this clear. For example, Pesco makes 127 different fuel pumps, 49 different types of gear pumps, 42 types of vacuum pumps, 27 different hydraulic cylinders, and literally hundreds of types of valves. Scheduling is further complicated by the variety of springs used in the different units; also by the difference in paint specifications of the services, including black, gray, and green.

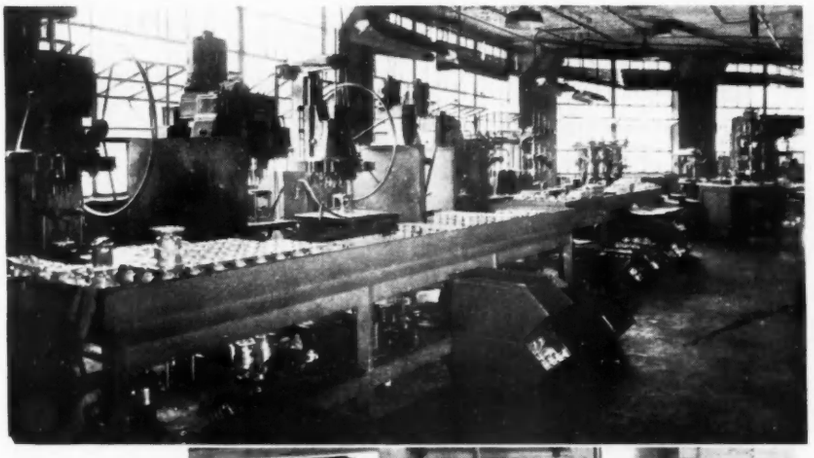
Features Reorganized

Manufacturing operations of the Pump Engineering Service Corp.

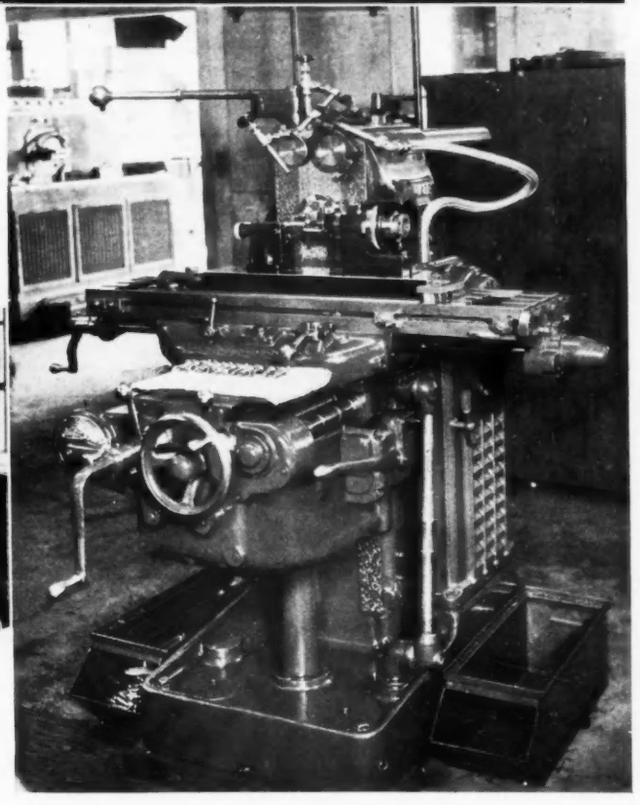
Nor is the manufacturing problem simplified by the character of the materials that go to make up the Pesco units. For example, about 90 per cent of the bodies are made of aluminum. And the rotors and blades of the fuel pumps are made of Nitralloy. Practically, this means that new material orders alone require a waiting period of about 90 days under wartime conditions.

Even a cursory examination of the plant gives evidence of good management. In the first place, the entire operation exemplifies the very essence of FLEXIBILITY—in the layout and disposition of machine departments, in the selection and tooling of equipment. Too, there is the evidence of good housekeeping — scrupulously clean floors and machinery, well painted walls and ceilings, good lighting to promote better seeing and, consequently, better quality.

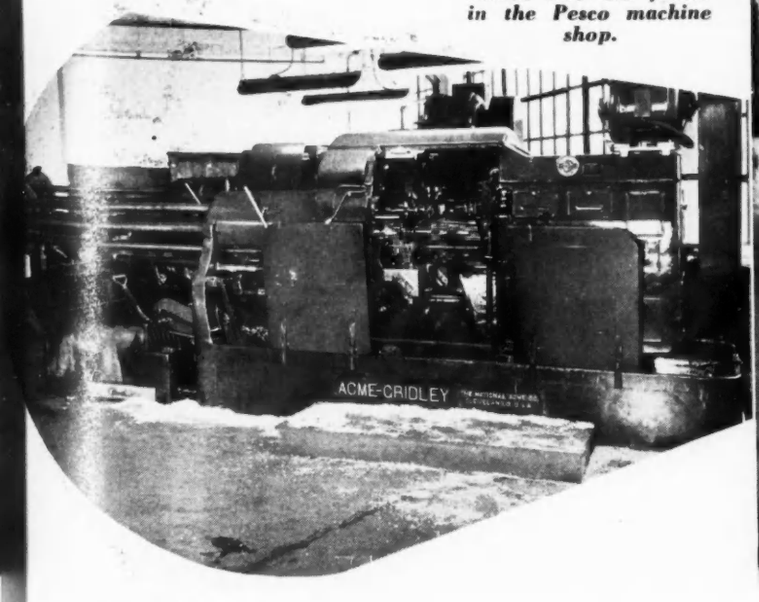
The endless variety of types and sizes precludes the possibility of a straight line production layout for



(Above) One section of the drill press department, featuring a number of small multiple-spindle drills made by Natco.



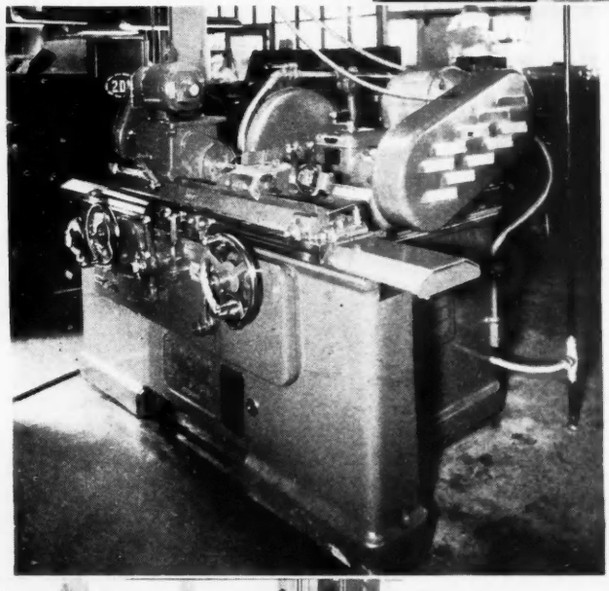
(Right) Kearney & Trecker milling machines also are found in the Pesco machine shop.



(Below) Towering over the other equipment in the screw machine department are the big six-spindle Acme-Gridley automatics.

(Top) General perspective of the final assembly department. All of the Pesco equipment made in this plant is assembled by skilled craftsmen on these individual work benches.

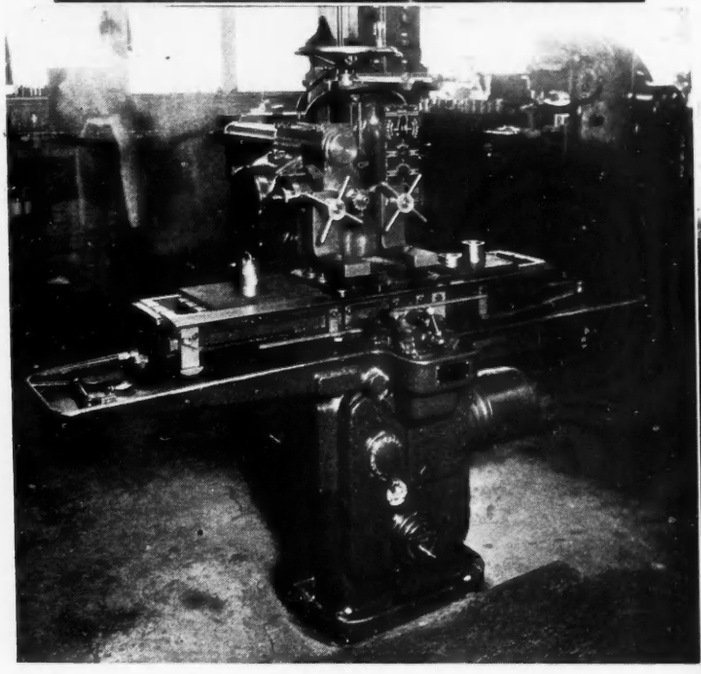
(Below) Norton cylindrical grinder of the latest type is used for final grinding operations in the lathe department.

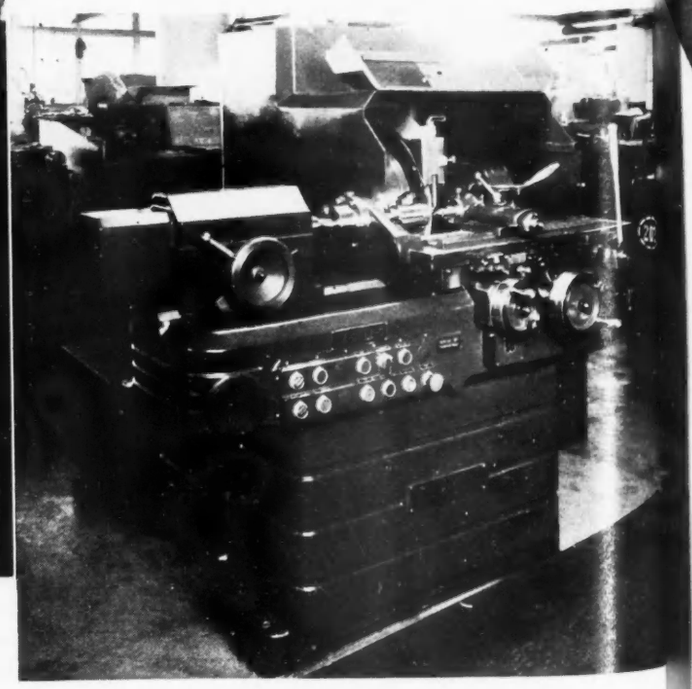


any of the units made here. Accordingly, every machine shop function has been departmentalized into separate groups such as turret lathes, engine lathes, grinders, screw machines, etc. However, the departments have been so arranged as to permit a smooth flow of the product without back-tracking and with the very minimum of materials handling. Equipment, in turn, has been selected with a view to quick change-over of any given setup, and so tooled as to make the change-over as rapid as possible. All of these elements

(Lower left) This Sundstrand Rigidmill is one of a battery of milling machines of various makes in the machine shop.

(Below) Ex-Cell-O precision thread grinder is used for cutting various threaded members. A large battery of Ex-Cell-O precision boring machines is located in an adjoining department.



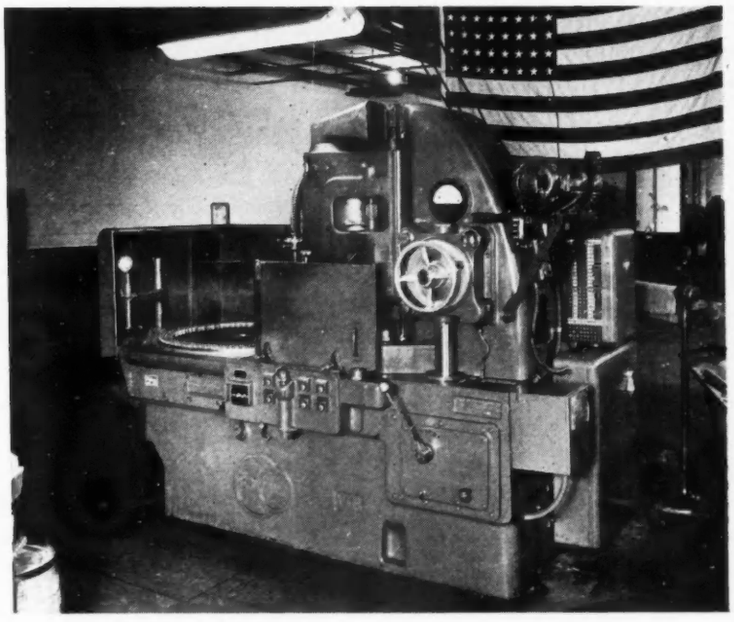


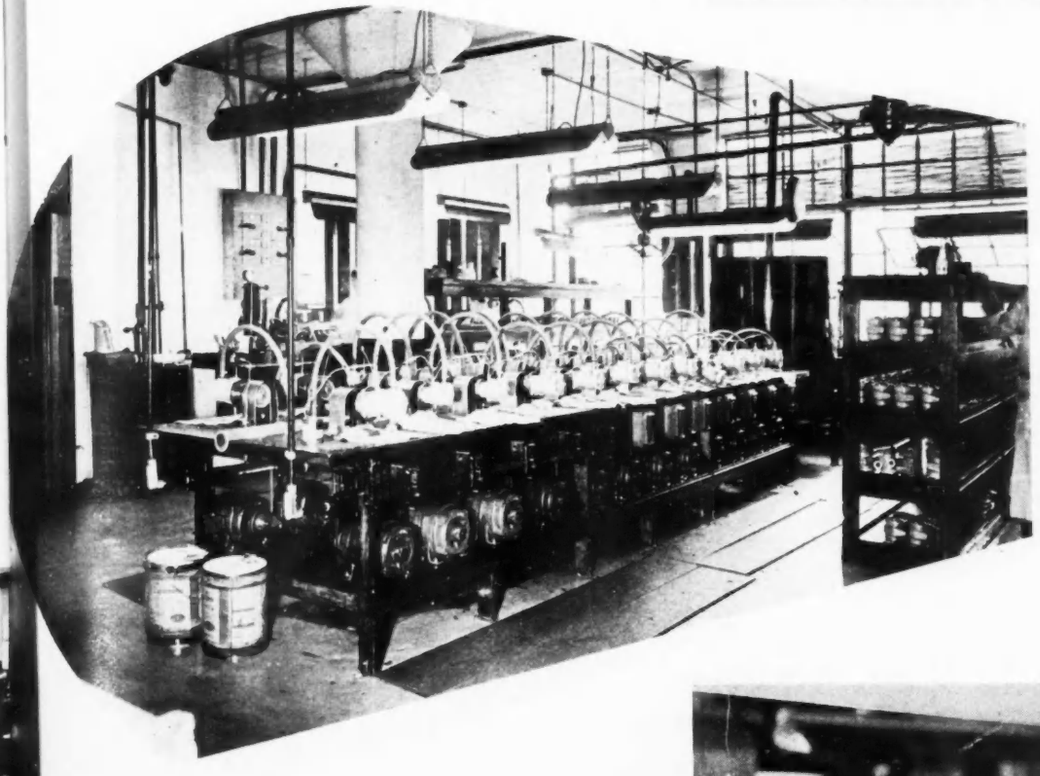
as a function of the setup connote flexibility and imply the nearest approach to the application of mass production methods to an operation of this character.

The individual machining operations have been broken down into the most simple form to avoid complexity and to make it possible to utilize more or less general purpose type equipment. Nevertheless, there is no compromise as to the rigid quality requirements of the services. Consequently, each operation is held under rigid control with the aid of well designed fixtures and tooling and inspection devices.

Going through the machine shop departments we find familiar activities. Here, for example, is the drill press group. This consists primarily of small precision drills such as the sensitive Avey drills and Natco multiple-spindle drills. Warner & Swasey equipment dominates the turning and boring operations. One line-up has a large battery of chucking type W & S turret lathes; another of W & S bar type turret lathes. It is of interest to find that most of the precision boring operations are done in the same set-up on the turret lathes, all of which are tooled with Carboloy for aluminum and steel cutting. Certain precision boring operations are handled in a battery of three general purpose type

(*Turn to page* 76, *please*)

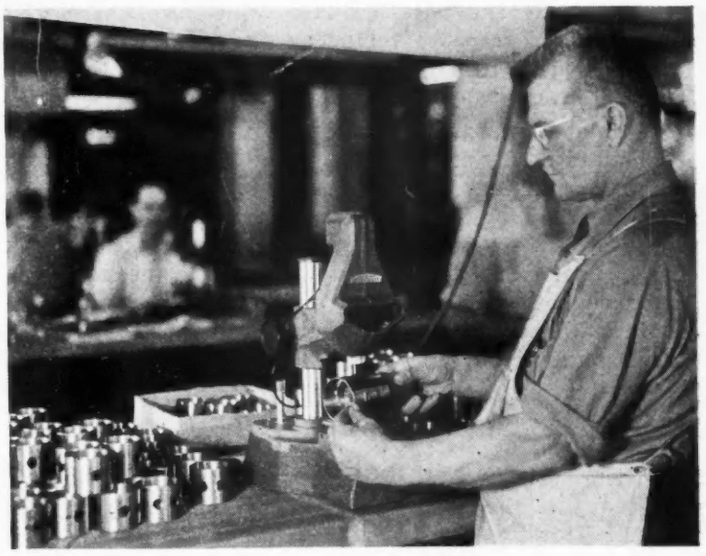


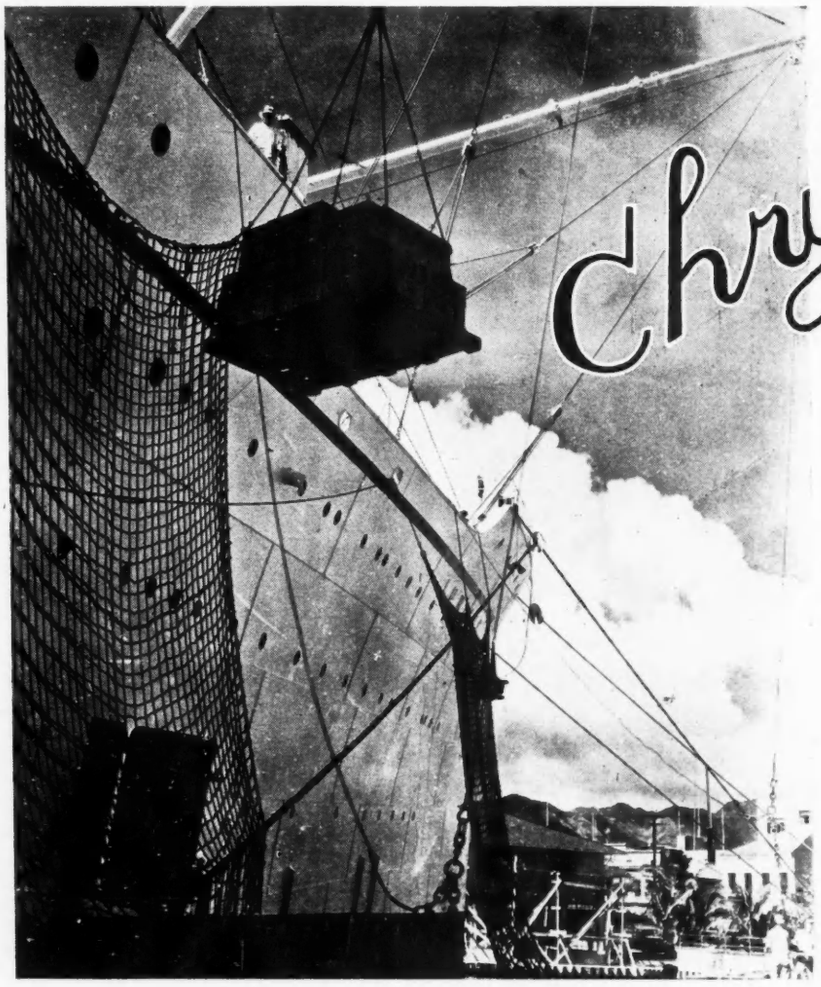


(Above) This new Blanachard surface grinder provides an excellent method of finish grinding small parts. Note that hundreds of small pieces can be accommodated on the magnetic chuck.

(Left) View of one of the final test rooms showing a fuel pump test bench.

(Below) Prominent piece of equipment in the final inspection department is the new Sheffield gage of 1000 to 1 magnification.





Chrysler Packaging

LACK of a replacement part such as a valve or piston ring may as effectively put an Army truck or tank in some far battle outpost out of operation as a direct hit on the engine or rear axle. Spare parts for the mechanized and motorized units of the United Nations will go a long way towards winning the war. One military authority has aptly stated that that army will win that has the best remnants. It is the ability to repair quickly and put back into action an army's equipment, to keep 'em rolling and keep 'em flying, that will prove an important factor in deciding the outcome in most any theater of war.

In order that spare parts for military vehicles may be shipped to any sector of the world-wide conflict, a dozen Chrysler Corp. parts and packaging experts have been working for three months on a standard packaging system for such parts. These parts packages must be so arranged that they can withstand the cold and snow of Iceland and Russia or the tropical heat of India and Panama. They must be waterproof and keep the contents rustproof to the greatest degree possible.

The Quartermaster Corps set down certain principles to be followed in setting up this packaging system. First, the parts must have maximum protection and easy identification. Second, the system must coordinate with the Army's parts supply handling procedure. Third, the packs should be designed to serve as a field vending medium.

Chrysler packaging and parts experts laid out the replacement parts for a typical military vehicle —the Dodge weapon carrier—as specified by the Motor Transport Division of the Quartermaster Corps. There were 1100 service part numbers for that vehicle. Then the parts supply for five other models in the Dodge line of Army vehicles, including the command reconnaissance car, command radio car, troop and supply transport, carry-all, and ambulance, also was worked out. A huge percentage of parts are interchangeable in these vehicles, but there are variations in certain body and chassis parts.

It was found that under the parts program developed by the Motor Transport Division, based on the incidence of repair for all parts, a unit of 100 vehicles would require 34,000 parts, weighing a total of 40,000 lb. Then the problem was to package these 34,000 parts in the most convenient and practical form. First the parts were sorted on the

System for Army Replacement Parts

By E. L. Warner, Jr.

basis of those that were interchangeable among the six vehicle models, such as sparkplugs and piston rings, and those that were peculiar to a particular model, such as springs and lights.

After that the parts were sorted by Army maintenance echelons. The second echelon takes care of field and roadside repairs, the third echelon is a mobile shop operating in the field for more extensive repairs and the fourth echelon is a base depot where overhauls and similar jobs can be handled. The

(*Turn to page* 80, *please*)

Indentification

1. Identification stenciled on bulky parts.
2. Parts not suitable for stencil are tagged.
3. All internal packages identified on all six sides.
4. Each wooden box in each lot numbered.
5. Contents of each wooden box standardized for all lots.
6. All wooden boxes identified as to contents with other vital data on rust proof metal identification plate attached to side of box.
7. Duplicate information on weather-proof plate included inside box.
8. Box directory showing box numbers in which each part is packed, to be inserted in box No. 1 and every 5th box in each lot.
9. All parts are tightly packed in cartons and boxes and no dunnage such as excelsior or wadding used. Open spaces within wooden box filled to prevent shifting of parts with bracing, wood framework or step trays.

Rust-proofing

1. Rust-proofing applied to Chrysler engineering specifications.
2. Self-sealing waterproof wrapping added to electrical and machined surface parts.
3. Packaged in waxed, moisture resistant, fibre container.
4. Extra protection provided in corrugated cartons, wax treated inside and outside.
5. Parts then packed in moisture resistant sealed bag.
6. Parts then placed in tongue and grooved wooden boxes and reinforced lid. Hinged and screw fastened.
7. Before closing lid, top of moisture resistant sealed bag is covered with sealing compound and a sheet of water-proof material applied to form internal watershed.
8. Steel strap applied to add structural strength and prevent theft or sabotage. All boxes camouflaged with gray lustreless paint to prevent light reflection.

Bullard's New Reclamation S

By Robinson D. Bullard*

ALTHOUGH still in the development stage, the new reclamation system being installed at the Bullard plant now is saving 25,000 gal. of both lubricating and cutting oils a year, is handling briquettes at an annual rate of 15,000,000 lb., is preventing a yearly loss of more than 125,000 lb. of woolen and cotton waste, and is squeezing every possible hour of use from the thousands of cutting tools used in the manufacture of Mult-Au-Matic and Vertical Turret Lathes. Of course, the program has proved itself financially successful, but more important in the present crisis is the fact that the firm's demand for virgin metals and oils upon an overloaded market is being reduced to the minimum. And with transportation facilities restricted, these reclaimed materials are freeing the equivalent of more than 250 freight cars a year, with even greater savings to come as the program grows.

In setting up a well-defined reclamation program, it has been found essential that responsibility for its operations be placed upon a single, centralized authority. That is the first step. Only through the establishment of a distinctly autonomous salvage department can the reclamation of diversified scrap and waste be coordinated intelligently.

The nature of the work at the Bullard plant naturally requires the use of a great variety and number of cutting tools, and the salvage department has had a large measure of success in reclaiming small tools that have become worn or broken. First of all, discarded tools are inspected and catalogued to determine the possibility of reconditioning them for use within the plant. If the tools cannot be ground down to precision requirements, they are catalogued and made available to other manufacturers in the area.

The second major project of the reclamation division is in the salvaging of cutting oil. Usually about 30 per cent of this oil is removed from turnings on machining operations. The oil can be extracted from the turnings either by the use of self-draining storage bins or by mechanical extraction. Self-draining bins are, of course, more feasible for the smaller plant.

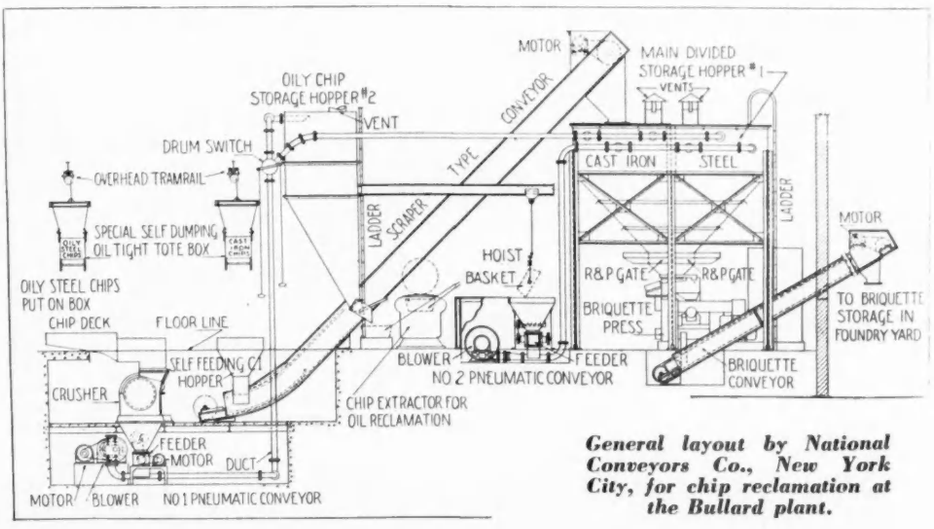
The reclamation of lubricating oils has been another primary problem. Since the plant is operating 24 hours a day and seven days a week, frequent oil changes leave a great volume of used lubricant. This residue is cleaned and then blended with a heavier oil for use in hand-oiling operations, and, when the excess grows beyond our normal requirements, cutting oil concentrates are added to it for use with the regular cutting lubricants.

In establishing an all-around salvage section, the possibility of substituting shop wiping cloths for waste and rags should be investigated. While prevention of waste on wiping materials may seem at first glance to be a comparatively minor matter, the Bullard company has found that under present production schedules, about 11,000 lb. of cotton waste and wool rags would be used in one month which, in most instances, would represent a total loss of material. To eliminate this loss, we are using 90,000 wiping towels a month from an outside laundry source and, of these, we are losing only about 350 lb.

Perhaps the most important reclamation work in any machine shop consists of the recovery of steel turnings, cast iron borings and other material removed by machining. Steel turnings, for instance, may contain a very considerable amount of alloying elements, such as nickel and chromium.

The Bullard company has installed a complete reclamation plant (see illustration) for converting cast iron borings and steel turnings into a suitable material for re-melting. In planning this system, we first

* Reclamation Engineer, The Bullard Co., Bridgeport, Conn., and technical consultant to the Industrial Salvage Section of the War Production Board.



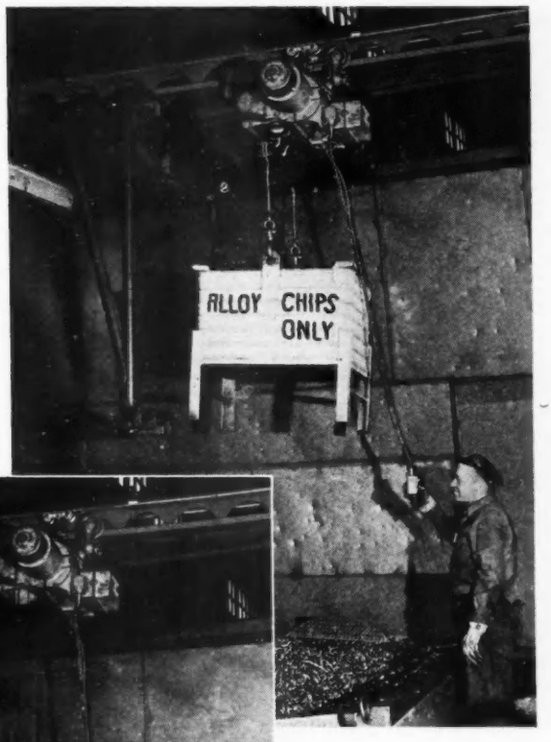
General layout by National Conveyors Co., New York City, for chip reclamation at the Bullard plant.

System

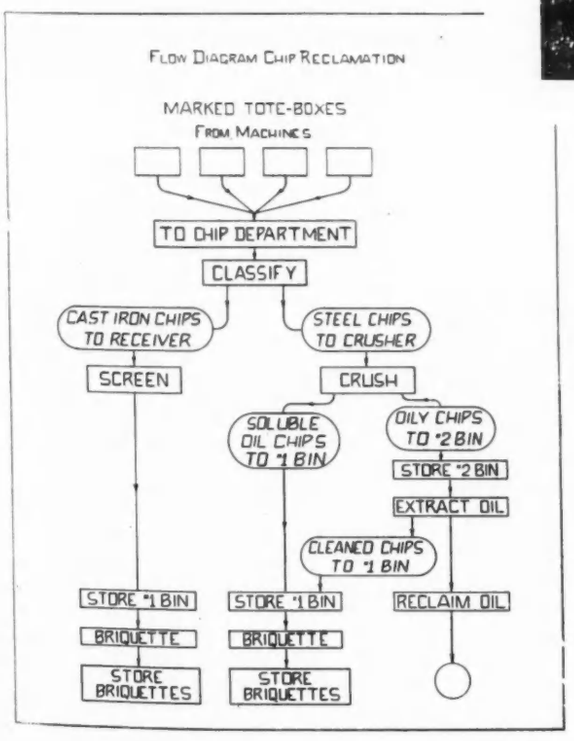
developed a flow diagram, which is shown here. From this you will note that the material is segregated at the production machine by providing properly marked oil-tight tote boxes. These tote boxes, besides being properly lettered, are further identified by paint of different colors, depending, of course, upon the type of material they are to contain. Under the system now in operation, the full tote boxes are first transported to the chip department where the various types of material are classified and stored prior to processing.

As shown in the flow diagram, cast iron borings are briquetted without any other preliminary treatment than to remove shop refuse. The steel turnings prior to briquetting require crushing and, if they are machined with mineral cutting oil, extraction of that oil is necessary. The different briquettes, after completion of the process, are conveyed to classified storage hoppers in the foundry yard, which are accessible to the crane used for charging the cupola.

All tote boxes are handled with an overhead mono-rail, which works in conjunction with the special dumping arrangement shown in the accompanying illustration. Cast iron chips are dumped into a receiving hopper, passed through a vibrating screen and carried by a scraper-type conveyor to one compartment of the main storage hopper, which is over the briquetting machine.



Special dumping arrangement for tote boxes handled on mono-rail conveyor.



Steel chips are dumped onto a deck which slants at a slight angle to enlist the aid of gravity in feeding the chips manually into the crusher. Two types of chips are handled in this manner—those machined with mineral oil and those machined with soluble oil. As it is important that the mineral oil be recovered, the mineral oil chips are first conveyed to an oily chip storage hopper. The oil is here taken out by a centrifugal extractor and the chips are then conveyed by a second pneumatic conveyor to one compartment in the main storage hopper. The soluble oil chips are conveyed directly to another compartment in this same hopper. It will be noted that this system permits the operation of the crusher and extractor independently of each other.

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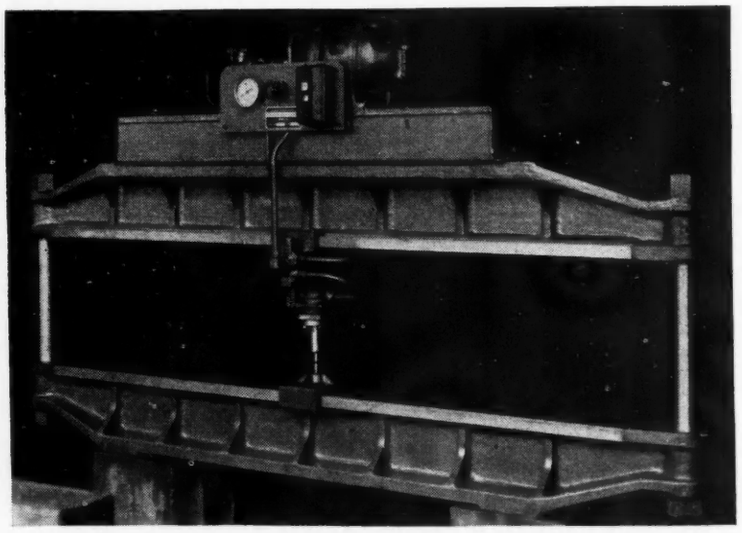
MEN and



Manufactured by the Lake Erie Engineering Corp., Buffalo, N. Y., this 10-ton hydraulic riveting machine is entirely self-contained. A manually-operated valve controls the pressure of the riveting ram which has a stroke of 3 in. The distance between tie rods is 9 ft 10in.; the distance between beams, 21½ in.

THREE new dial indicator gages have been introduced by Federal Products Corp., Providence, R. I. One, an inside diameter gage for large shallow holes, was designed for checking the inside diameter of a gear accessory drive used in an airplane motor. The gage covers a range of 0.075 in. and is supplied with a dial graduated in thousandths of an inch. The standard model has a capacity of 7.80 in., although the gage may be made in other sizes for different required measurements.

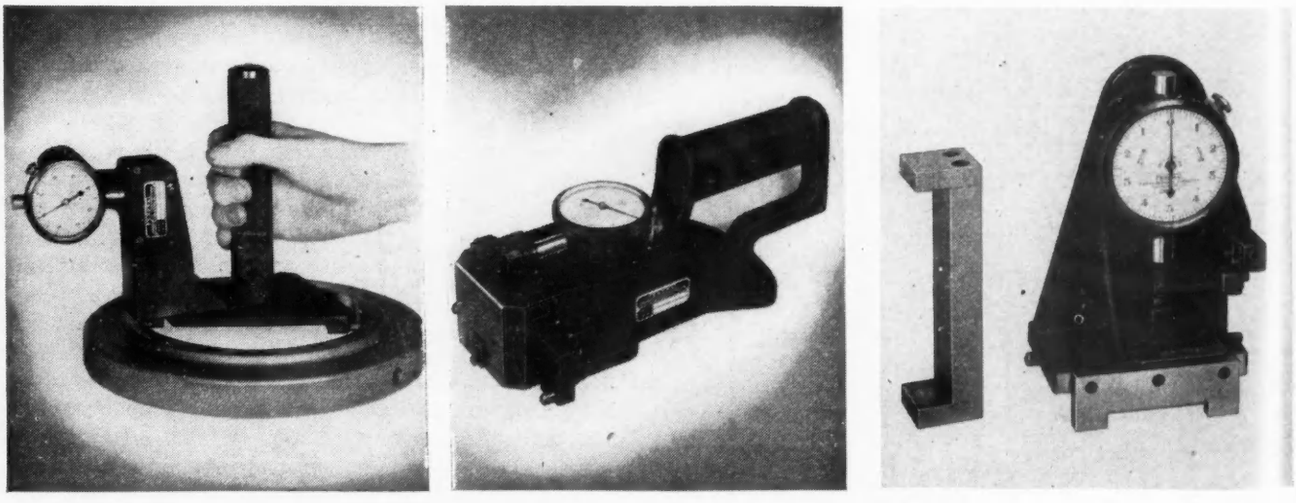
Another gage is built specifically for checking a shallow recess 6.80 in. in diameter. It is graduated in ten-thousandths of an inch and has a range of 0.025 in. The third gage is designed for checking the distance between faces of crankshaft bearings. It is furnished in several models.

THE B. F. Goodrich Co., Akron, Ohio, has announced several new developments in the production of sponge rubber. Showing remarkable resistance to aging, heat, and deterioration in oil, sponge fabricated from Amperipol, a product produced by the polymerization of butadiene, is offered in the form of sheets, tubing, cord, and various molded shapes. At present this product is supplied in only one color, black, and one density, medium.

Conforming its production to war conditions, the company is also fabricating sponge rubber from 100 per cent reclaimed rubber. Studies by its research staff have resulted in the fabrication of a sponge which conforms favorably in compression ability to that produced from crude rubber. Manufacturing methods are essentially the same.

TUBING fittings molded from Saran, a new thermoplastic resin, make it possible to set up a completely chemical-resistant piping system in which no metal at all is used. The new fittings, made by the Acadia Synthetic Products Division of the Western Felt Works, Chicago, Ill., are furnished in sizes for use with tubing ranging in size from ⅛ to ⅜ in. outside diameter.

New acorn-type Palnuts similar in design to regular Palnuts manufactured by The Palnut Co., Irvington, N. J., are stamped from spring steel, heat-treated, and plated. The new nuts are recommended for use wherever a reasonably strong self-locking nut is required. The nut is made in three sizes: 6-32, 10-24, and ¼ in.-20.



These gages, built by the Federal Products Corp., are especially designed for use in the production checking of aircraft engine parts. Model 167 P-75 (left) is an inside diameter gage for shallow holes and recesses; Model 167 P-71 (middle) is another inside diameter gage for large shallow holes; and Model 294 P-26 (right) is a gage for checking the distance between the faces of crankshaft bearings.

MACHINES

THE CURRAN CORP., Malden, Mass., has developed a new safety solvent for hand wiping and various industrial uses. Known as Gunk XP-92, the new compound, a substitute for naptha solvents, is said to have no harmful effects on the skin, to give off no toxic vapors, and to have no flash or fire point.

Another development, a new patented use for Gunk, the self-emulsifying degreasing solvent, permits the use of this solvent in treating gun bores or other metal surfaces which have been exposed to salt water and which require cleaning, lubricating, and preservative treatment.

Capable of handling wet or dry sanding of wood, metal, or composition surfaces, this 3½-lb hand sander manufactured by National Air Sander, Inc., Rockford, Ill., operates on an air line pressure of 50 psi.

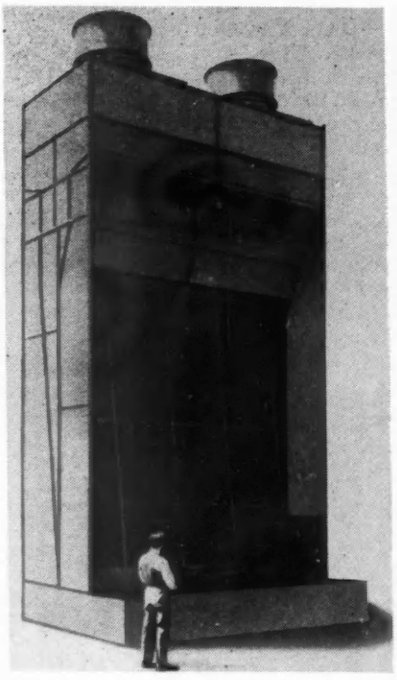
DESIGNED for the lubrication of machinery in plants where maintenance must be reduced to a minimum, several new portable service stations offered by the Alemite Division, Stewart-Warner Corp., Chicago, Ill., are supplied in two models, the Standard and the Advanced.

The Standard models, of four and six unit capacity, include a high-pressure pump with 20 ft of hose carried on a reel for pressure gun fittings, and low-pressure power pumps with 15 ft of hose for dispensing gear lubricants and machine oil. Two or more hand-operated pumps, depending on model size, for dispensing lubricants and oil, and a hand-operated pump for loading hand guns, are also part of the Standard model equipment.

The Advanced models have capacity for six 50-lb lubricant units. One high-pressure pump with 20 ft of reeled hose, and two low-pressure pumps with 15 ft of hose are supplied in addition to two hand-operated units with registering meter for dispensing light oils and one hand-operated loader for filling hand guns.

All models are supplied with an air compressor, or with an air hose for quick connection to factory air lines.

IN THE near future, according to an announcement by the DeVilbiss Co., Toledo, Ohio, the world's largest water-wash spray booth will be placed in operation in an aircraft plant. It will be 152 ft long, 100 ft deep, and 31 ft high. Designed for painting large bomber parts and complete planes, the booth will consist of eight compartments grouped in pairs with a six-foot space between pairs to accomodate 100-foot motor-driven accordion partitions.



This unit, one of eight DeVilbiss booths being installed in a large aircraft plant, is part of a large water-wash spray booth capable of handling a complete airplane.

In the complete installation, a total of 192,000 gallons of water will be used each hour. Air is drawn through the curtain of water in each compartment by two 48-in. fans each driven by a 7½-hp motor. With the entire unit in operation, the sixteen fans will move a total of 496,000 cu ft of air per min. This exhaust system is said to effect the complete removal of spray vapors from all parts of the booth.

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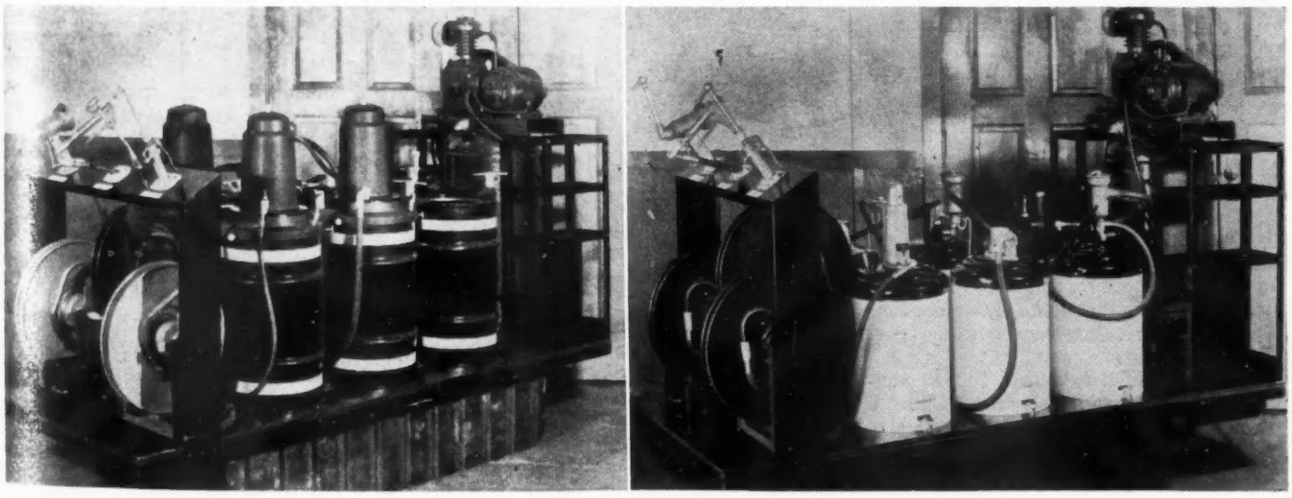
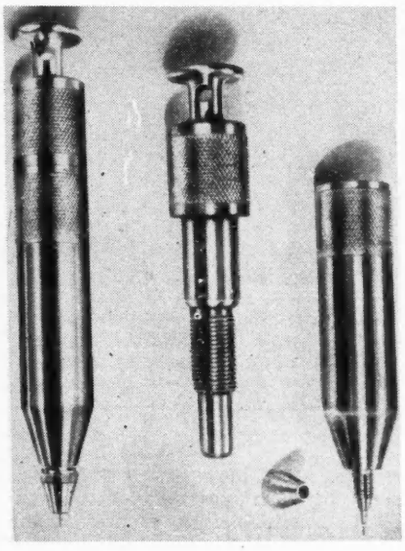


Several new models of industrial lubrication units have been developed by the Alemite Division of the Stewart-Warner Corp. A Standard model is shown at the left, and an Advance model at the right.

ABRASIVE pencils, produced by the Behr-Manning Division of the Norton Co., Troy, N. Y., are finding many uses in modern production. Furnished in lengths up to three inches, and diameters up to one inch, they are formed from Behr-Manning Metalite cloth in all grit numbers for fitting on slotted or solid mandrels. The pencils are supplied in three types: full-glued, half-glued, or taped. The half-glued types are especially useful in some operations, since a new abrasive surface is immediately presented by tearing off the used portion.



This new precision plumb bob has been announced by Aero Tool Co., Burbank, Cal. Worn phonograph needles chucked in a jeweler's vise in the indicating end and a two-piece threaded construction permitting the point to be raised or lowered about ½ in. are said to provide maximum precision.

TO SERVE companies unable to furnish high priority ratings, the Stoody Co., Whittier, Cal., has developed two new hard-facing alloys which are being marketed under the trade names of Stoodite K and Stoody Self-Hardening K. Each is available under the regular A-10, P-100 rating. Complete information may be obtained by addressing the Air Reduction Sales Co., New York, N. Y.

Stoodite K, which is recommended for the hard-facing of various types of agricultural tools, cement mill parts, brick and clay equipment, etc., is composed principally of molybdenum, tungsten, manganese, silicon, carbon, and iron. It is available in 14-in. rods supplied in five diameters ranging from ⅛ in. to ⅜ in.

Stoody Self-Hardening K is composed principally of the same elements with the exception of tungsten which is replaced by vanadium. It is made in the form of tubes with the mixed alloys on the inside, and is supplied in three rod diameters: ⅛, 3/16, and ¼ in. Electric rods are 14 in. long; acetylene rods, 28 in. This rod is recommended for the hard-facing of equipment subjected to both hard wear and severe impact.

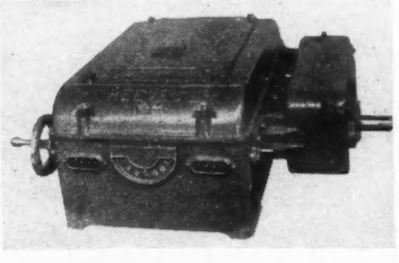
A NEW Du Pont industrial cement, "Fairprene", manufactured by the Fabrikoid Division, E. I. du Pont de Nemours & Co., Fairfield, Conn., appears to be a likely substitute for rubber cement. Supplied in various grades, the new cement is described as an unvulcanized synthetic composition, dispersed in a suitable solvent, which contains the activating ingredients for vulcanization with heat, or is so formulated that vulcanization will take place at atmospheric temperatures with the addition of a solution of activating ingredients.

The new cement may be used to join various combinations of cured and uncured neoprene stock, cured and uncured neoprene-coated fabrics, cured and uncured rubber, leather fabrics, and paper. It can also be used in sheet-metal joints of aluminum and aluminum alloys preparatory to riveting in the fabrication of fuel tanks and waterproof compartments.

A NEW TYPE of plate glass that floats like cork and can be used as the buoyant element in many items of war equipment is now in production by the Pittsburgh Corning Corp., Pittsburgh, Pa.

The new product, called Foamglass, is opaque, rigid, fireproof, and verminproof. It is said to combine valuable insulating properties with a weight of only ten pounds per cubic foot. Offered as a substitute for balsa wood, cork, cellular rubber, and kapok, all of which are largely imported, the new glass is produced by firing ordinary glass which has been mixed with a small quantity of pure carbon. During the melting process, the carbon turns to a gas which is evenly distributed throughout the molten glass. The resulting product is a vitreous slab in which the cells are uniformly small in size and entirely sealed from each other.

Foamglass is available in 12-by-18-inch slabs, 2, 3, 4½, or 6 in. thick. Ordinary tools can be used to saw or drill it.



The Reeves Pulley Co., Columbus, Ind., has developed this special design of the Reeves variable-speed transmission which is equipped with a built-in chain-drive reducer operating in a bath of oil. The output speed may be changed between limits through an infinitely-variable range.

Oil-proof molded parts such as gaskets, diaphragms, washers, etc., can be formed from Resistoflex PVA materials supplied by the Resistoflex Corp., Belleville, N. J. Many of the parts are made of the clear, unreinforced material; others are made of sheets containing fabric or metal inserts or backing. All of these products are said to be impervious to oils and organic solvents of all kinds.

Other new developments are briefly described in the following paragraphs:

Lead-base Substitutes

Lead-base substitutes for tin-base babbitts, Pyramid Metal for heavy sustained pressures, and Defender Metal for shock loads, have been announced by Magnolia Metal Co., Elizabeth, N. J.

Burr Remover

Chucked spindle wound with Type-A American steel wool ribbon forms efficient tool for removing burrs. Ribbon supplied by the American Steel Wool Mfg. Co., Long Island City, N. Y.

Jo'nt Sealer

Prestite joint sealer for aluminum and synthetic glass is said to be unaffected by exposure to air, water, 100-octane gasoline, and motor oil. Furnished in widths from 0.625 to 2.0 in., and in thickness from 0.020 to 0.125 in. by Prestite Engineering Co., St. Louis, Mo.

Koroseal Tubing

Fibronized Koroseal tubing for use as electrical insulator supplied in A. S. T. M. sizes in a variety of colors by Irvington Varnish & Insulator Co., Irvington, N. J.

Solderless Terminals

Two lines of solderless terminals, one supplied for wire sizes 18, 20, or 22, and the other, a plug-type for use on panel boards, supplied for wire sizes 14 or 16, are offered by Aircraft-Marine Products, Inc., Elizabeth, N. J.

British Practice in Reconditioning Worn Parts

IN VIEW of the increasing shortage of materials and labor available for the production of replacement parts for civilian vehicles, including buses and trucks, the British Ministry of Supply, in cooperation with the Society of Motor Manufacturers and Traders and the Motor Agents Association, has inaugurated a campaign with the object of encouraging operators and repairers to do all they can to give a fresh lease of life to worn parts that normally would be scrapped. Manufacturers are assisting by offering advice where needed, and renewed interest is directed toward a report published early this year by the Institution of Automobile Engineers reviewing the experience and practice of a number of bus- and truck-operating companies in this connection. Following are some examples of treatments reported upon in specific cases.

As regards worn crankshafts, the operators' reports are said to confirm the value of chromium-plating crank pins and journals in cases of excessive wear and scoring. Sprayed-on metal in the case of crankpins is said by one operator to have been unsuccessful, the deposited metal coming loose after 24,000 miles. Worn cams have been successfully stellited and reground in some cases, while good results have followed the welding-up and re-cutting of worm threads on camshafts.

Minor cracking and burning of the faces of cylinder heads and blocks resulting from blown gaskets may be repaired by bronze welding, it is stated; but metal spraying proved unsuccessful also where an aluminum head was cracked near a spark-plug hole, and in the case of a crack in a cylinder block between valve port and bore. A proprietary compound known as "Wonder Weld" is stated, on the other hand, to have been effective in the repair of cylinder blocks cracked by frost.

Oxy-acetylene welding of cracked or damaged cast-iron cylinder heads and blocks and crankcases is favorably reported upon.

Worn valve stems have been built up to standard size by chromium plating, valve guides rebored oversize for valve stems of larger than standard diameter or filled with bronze welding rod and rebored to standard size, tappets faced with stellite and their diameter restored by chromium plating, the latter treatment being applied also to valve rockers and their shafts and to water-pump steel spindles.

Worn starter pinions and gear rings have been loaded with manganese welding material and recut and oil-pump drive gears electrically welded with a hard alloy. One operator enlarges the ring grooves of aluminum pistons after 60,0000 miles and fits overwidth rings. In some cases satisfactory results are said to have followed the welding-up solid of broken ring grooves in aluminum pistons and cutting fresh grooves. Piston-skirt wear is dealt with by expanding the skirt by the Koetherizing process. Wrist-pin holes are bored out to 3/32 in. oversize, and bronze bushings are fitted for standard size pins. An alternative plan is to ream the holes oversize and refit the original pins made oversize by chromium plating.

Chromium plating is used for reconditioning many other parts, among them being worn clutch plates, clutch-shaft pilot ends, gear-shaft journals and splines, differential pinion carriers, spring-shackle pins and front-axle swivel pins. It is stated that the deposited chromium shows resistance to wear equal to (if not exceeding) that of a case-hardened surface, and that light deposits can be applied to simple parts with sufficient accuracy to obviate subsequent machining. On the other hand, there is a slight reduction in the fatigue strength of a journal after chromium plating; parts treated in this way can be finished only by grinding; on irregularly shaped parts the deposit is not uniform in thickness, and thick deposits are not practicable unless the parts are of simple shape.

Nickel plating is used in some cases as an alternative to chromium plating, on worn axle-shaft splines, for instance. But when these show appreciable wear they are built up by welding and re-splined, with the new splines cut so that the forward driving faces are on parent metal.

Brake camshafts have nickel-chrome welding rod applied to their worn surfaces, prior to being trued up and ground to standard size and shape. One operator reports that many of his brake camshafts have been reconditioned three times already by this process. Brake-rod fork ends often are welded and re-drilled, hand-brake trigger pawls are stellited, and Lockheed brake cylinder bores have been reconditioned with success by chromium plating.

Road-wheel centers stretched on the bearing housings sometimes are rebored 1/8 in. oversize and have a steel liner fitted; in other cases slack bearing housings have been brought back to original size by metal spraying, bronze welding or nickel plating. Ball bearings are reconditioned by grinding out the ball tracks and fitting oversize balls, and the same treatment is applied to roller bearings of some types.

Parts Output Period Extended

New Order, L-158, Allowing Production Until End of '42, Affects Output and Distribution of All Functional Parts

Extension of the period for the production of replacement parts until the end of 1942, more complete inventory control of both producers and distributors, and a requirement that a similar used part must be turned in by a consumer in order to receive a new part from a distributor are among the chief features of the new limitation order L-158 which was issued July 4 by the Division of Industry Operations of the War Production Board. This supersedes orders L-35, L-4 and L-4-c governing the production of spare parts.

The new order extends the production of replacement parts to the fourth quarter of 1942 for passenger cars and light trucks. Manufacturers of functional spare parts for passenger cars and light trucks may make in the third and fourth quarters of 1942 up to 70 per cent of their total sales during the corresponding quarters of 1941. Previously, no provision had been made for such production after Sept. 30. However, the producer's inventory in September and December must not exceed four times his average monthly sales, valued at cost, during the preceding quarter. If the producer's inventory exceeds this figure, he may make up to 50 per cent of his total sales in the corresponding quarters of 1941 provided he does not increase his inventory at the end of either quarter above the inventory of finished parts at the beginning of the quarter. Under L-4-c, the 70 per cent production rate prevailed for the third quarter of 1942 and there also was a four-month inventory limit.

For manufacturers of replacement parts for medium and heavy trucks, truck tractors, truck trailers, passenger carriers, and off-the-highway vehicles, the production rate for the third and fourth quarters of 1942 is not to exceed 125 per cent of sales in the corresponding quarters of 1941. This is a slight reduction from order L-35 which permitted manufacture of spare parts up to 150 per cent of sales during the calendar year 1941. However, there is an accompanying inventory limitation similar to that for passenger cars and light trucks which restricts them to a four-month supply. If inventories are in excess of a four-month supply, spare parts may be manufactured not to exceed 75 per cent of dollar sales in the corresponding quarters of 1941 provided such production does not increase the supply of finished parts at the end of either quarter above that prevailing at the beginning of the quarter.

Under the new order, tire valve assemblies, frame suspension assemblies, signal horns, and windshield safety glass have been added to the list of functional replacement parts for passenger cars and light trucks. For medium and heavy trucks, fenders, unless they support built-in lighting; hoods, doors, door hardware, and radiator guards have been dropped from the list of functional replacement parts.

It is possible that the inventory limitation may work a hardship on certain manufacturers who stock some obsolete parts as insurance for owners of older models of their vehicles. These slow moving parts are added into the over-all totals and might make a producer's stock exceed the four-month limit.

The requirement that a consumer must turn in a similar used part when he receives a new part from a distributor will help to minimize hoarding of parts and will make it necessary that the consumer prove his need. Distributors are directed to recondition all parts that can be kept in service rather than sell a new part, provided reconditioning facilities are available. This is in line with the campaign of the Office of Defense Transportation to conserve spare parts in the truck field by rebuilding drive shafts, metal coating crankshafts, and refacing valves. Order L-126 prohibits distributors from selling a new exhaust valve to a consumer unless a worn valve is turned in. Some manufacturers also have followed this practice with gears, fan belts, spark plugs, and other parts.

It is possible that the turn-in requirement might prove a hardship to a fleet truck operator whose truck breaks down on the road and who then must dismantle part of the vehicle to bring in the broken axle, connecting rod or similar part. However, remedies for such contingencies may be worked out. The return requirement becomes effective July 15.

Whether the new order will help alleviate the prospective shortage of certain alloy steel parts such as axles, transmissions, gears, and crankshafts is problematical. Lack of materials and facilities has prevented manufacturers from building up any appreciable stocks on these items. On the other hand, there has been unusual demand for such parts from dealers, distributors, branches, and fleet truck owners. Many of the latter never stocked spare axles before relying on the normal sources of supply to obtain one when needed. But with an impending shortage of such parts, fleet owners have filled their supply rooms against the contingency of such repairs. Even on A-2 priority, truck manufacturers have been unable to get alloy steel for such uses. War demands are taking all such steel. In addition, some axle and transmission makers are so heavily engaged in war production that they have ceased production for civilian use entirely.

In the specialized truck field, there

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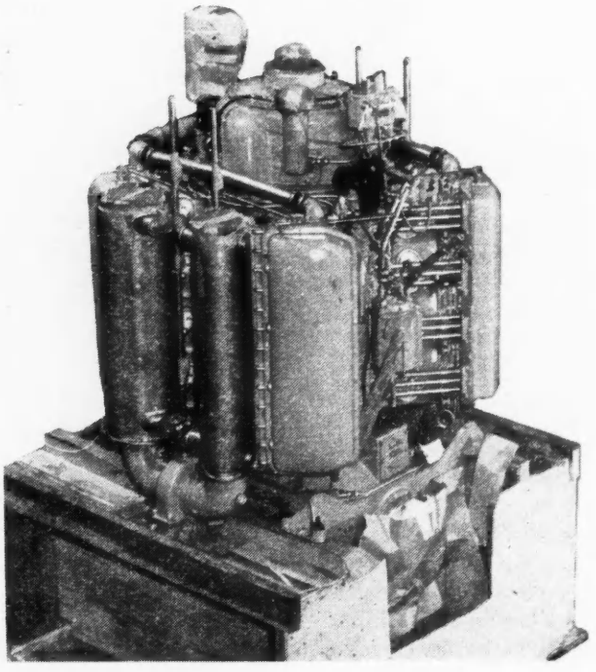


Sub Chaser Engine

The Electro-Motive Division of General Motors Corp. is now in full production of a variable-pitch marine propeller and this lightweight, high-speed Diesel engine consisting of four banks of four cylinders each grouped around a vertical crankshaft. The engine, reduction gear, and propeller-pitch control are designed as a complete unit using a bevel pinion and gear between the engine and the propeller shaft. Two engines are used in each chaser.

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE AND AVIATION INDUSTRIES

General business activity remains comparatively stable. The seasonally adjusted index of *The New York Times* for the week ended June 27 rose two fractional points above the figure for the preceding week to 130.2 per cent of the estimated normal, as against 132.1 a year ago. The unadjusted index of *The Journal of Commerce* for the same period advanced to 123.4 per cent of the 1927-29 average from 122.2 for the week before.

Department store sales during the fourth week of June, as reported by the Federal Reserve Board, were 8 per cent below the level a year ago, in contrast with an excess of 9 per cent over the comparable 1941 figure recorded a week earlier. The board's unadjusted index of sales for the period stood at the 1935-39 base average.

Railway freight loadings in the week ended June 27 totaled 853,441 cars, 1.0 per cent more than the number for the preceding week but 6.1 per cent below that of a year ago.

Electric power production rose more than seasonally in the same period and was 9.5 per cent greater than a year ago, as against a corresponding excess of 11.1 per cent registered a week earlier.

Crude oil output during the week ended June 27 averaged 3,719,450 barrels daily, 1350 barrels below the figure for the preceding week but 83,150 barrels more than the average output recommended by the Office of the Petroleum Coördinator.

Average daily production of bituminous coal in the same period was 1,863,000 tons, as compared with 1,850,000 tons for the week before and 1,860,000 tons a year ago.

Engineering construction contracts awarded during the first six months of 1942 totaled $4,905 million, exceeding by 72 per cent the corresponding sum last year, according to *Engineering News-Record*.

Professor Fisher's index of wholesale commodity prices for the week ended July 3 stands at 108.2 per cent of the 1926 average, as against 106.6 for the preceding week.

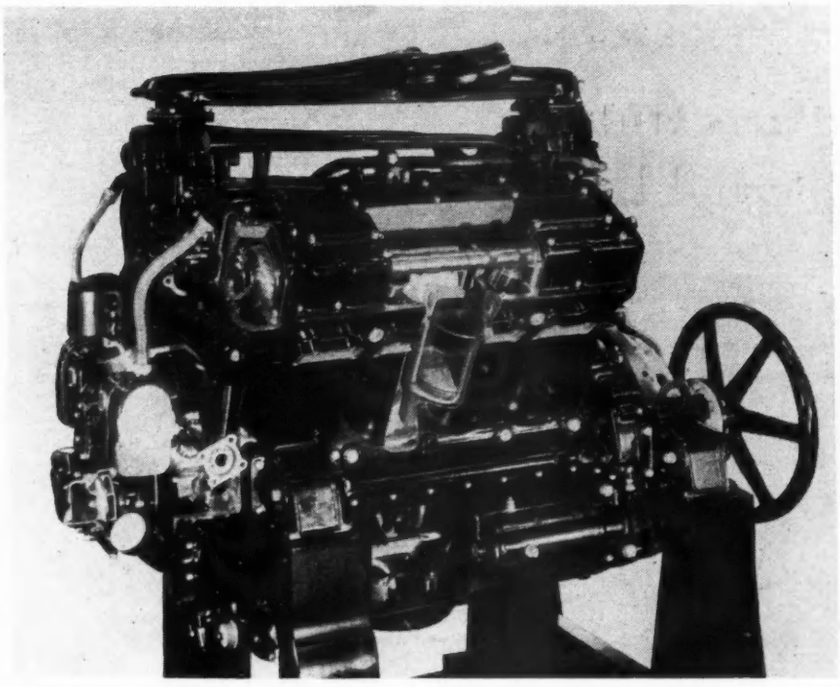
Member bank reserves declined $331 million during the week ended July 1, and estimated excess reserves dropped $390 million to a total of $2,260 million. Business loans of reporting members decreased $36 million in the same period and stood $572 million above the total a year ago.

Celebrate Output Mark

Sterling Aluminum Products of St. Louis, Missouri, is celebrating in the early part of July the production of its 33,000,000th piston.

Philip D. Block

Philip D. Block, former president and at the time of his death chairman of the executive committee of the Inland Steel Co., died late last month in Chicago.



Ford Tank Engine

Recently displayed in Detroit, this Ford tank engine is said to be a V-8 conversion of the Ford liquid-cooled aircraft engine. It is to be used to power medium tanks. Other information and technical details have been withheld.

Wildcat Strikes Slow War Production

Union Leaders Show Concern Over Many Work Stoppages, Await Settlement of Contracts with Ford, GM, Chrysler

Unauthorized work stoppages have become so prevalent in Michigan war production plants of late that R. J. Thomas, president of the UAW-CIO, editorially condemned such action on the part of union members in a recent issue of the *United Automobile Worker*, union publication. Citing three recent wildcat strikes, Thomas wrote, "They have served to give moral comfort to the enemies of our country." Thomas said that the disputes involved could have been worked out in an orderly manner through routine grievance procedure without stopping production on vital war work.

One of the wildcat strikes cited by Thomas was a one-day walkout at four Pontiac plants of the Yellow Truck & Coach Mfg. Co., one of the largest makers of Army trucks. Failure of the company to pay 4500 night shift workers for 20 minutes lost during a practice blackout by the City of Pontiac precipitated the strike. The pay loss averaged 36 cents apiece. Strikers lost an average of $8.80 apiece for the day's work missed. Settlement of the strike provided for blackout pay and disciplinary action against those responsible for the strike. Negotiations for a new contract have been under way since June 6.

A five-hour work stoppage involving 1500 employes at the Detroit Diesel Engine Division of GM was an outgrowth of a dispute over wage rates. Screw machine and grinding operators were granted $10,000 back pay by a GM umpire's decision last April for tending their machines during 15 minutes of their lunch hour. Dissatisfaction of other employes over the extra pay given to their fellow workers caused the walkout. This despite a recent plant-wide patriotic celebration at which workers at the plant pledged "to make my job my firing line."

Opposition to introduction of a six-day swing shift, which would deprive them of seven days' work per week and double time on the seventh day, caused a one-day walkout by 84 welders at the Kelsey-Hayes Wheel Co., Detroit. The swing shift was inaugurated at government request and with the agreement of the UAW-CIO. Another one-day strike involving 450 workers at the Monroe Auto Equipment Co. occurred when the men objected to a speedup on piece work operations on war contracts. Promised adjustment of rates paid screw machine operators brought a settlement.

General Motors Corp. and the UAW-CIO are awaiting a report of recom-

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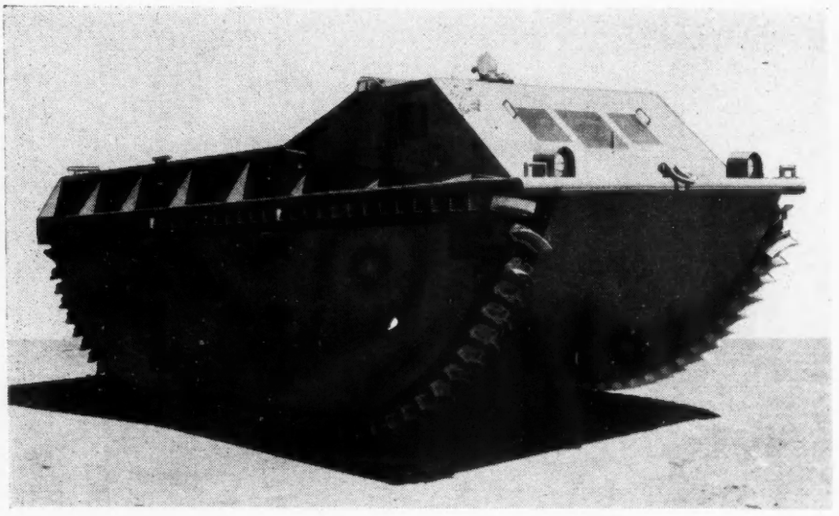


Navy's New Amphibian Tank

As reported in the last issue of AUTOMOTIVE AND AVIATION INDUSTRIES, the Graham-Paige Motors Corp. is producing large amphibian tanks for the Navy. No technical information has been released, but it is known that this type, designed for the transportation of men and materials, has passed the most rigorous testing over terrains likely to be encountered in landing operations. The paddle-shaped protrusions on the treads are said to give effective propulsion in water.

Alloy-Lean Steels Show Promise

Preliminary Tests Reveal Superiority in Some Properties; Bureau of Mines Plans Sponge Iron Pilot Plants

By W. C. Hirsch

Offsetting the depressing effect of much of the news regarding stocks of vital materials, comes information that good progress is being made in the development of alloy-lean steels that promise not only to fill gaps in the war emergency, but to have a permanent place in the roster of important constructional steels.

Some of the steels, of which initial heats have been subjected to preliminary tests by metallurgists of the American Iron & Steel Institute, have been proclaimed as superior in important properties to the steels with a higher alloy content, which they were designed to replace.

The latest report of the Conservation and Substitution Branch of the War Production Board's Bureau of Industrial Conservation reflects an important phase of the transition that the war emergency has made necessary. Molybdenum, formerly listed in a group of materials of which the supply was thought to be sufficient for war needs, with fair quantities available for essential civilian requirements is now classified as one of the materials with a very critical supply status.

The demand for molybdenum steels has grown by leaps and bounds since our entry into the war, and the range of the element's utilization has been impressively widened. It is interesting to note that lead, which in the previous enumeration of metals and their supply status had been grouped with relatively scarce metals, is now considered in adequate supply for all types of use and may be substituted for less plentiful materials. Here at least is one basic metal of which there is not only an increased supply, but also slightly less consumption.

Although only a few mills have had to resort to temporary shutdowns because of inability to obtain sufficient scrap for their melts, the problem,

(*Please turn to page* 60)

MEN . . . . . .

George W. Walker, Detroit industrial designer, has been appointed a consultant to Brig.-Gen. G. M. Barnes, chief, of the research and development service of the War Dept.

Earl H. Smith, executive engineer of the Aircraft Engine Division of Packard Motor Car Co., has been appointed secretary of the Detroit Section, SAE, succeeding **A. C. Hazard,** of Chevrolet, who resigned because of continued absence from the city.

E. F. Johnson has been elected a vice president of General Motors Corp. in charge of the Eastern Aircraft Division and of the six divisions in Dayton, O.—Frigidaire, Delco Products, Delco Brake, Moraine Products, Aeroproducts and Inland Mfg. For the past two years Johnson has been engaged in government war production work in Washington. Prior to that he was assistant to the GM vice president in charge of the parts and accessory divisions.

Lynn A. Williams, Jr. has been elected a vice president of Stewart-Warner Corp. He will continue in his position as secretary of the company and head of the legal dept.

R. A. Becker has been appointed manager of the Baltimore branch of Gar Wood Industries, Inc., succeeding **R. J. Grow.**

(*Please turn to page* 56)

CALENDAR

Conventions and Meetings

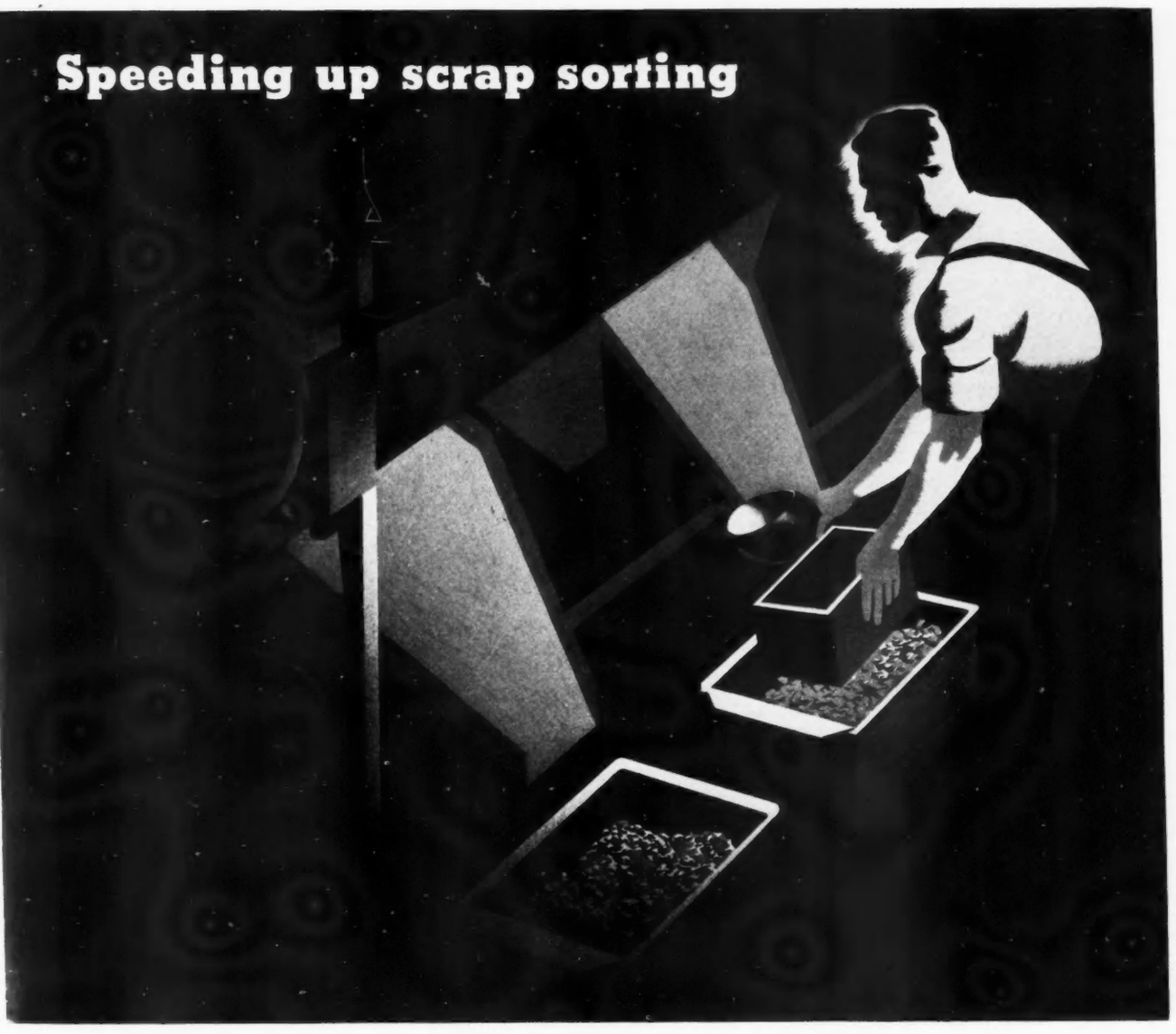
Natl. Standard Parts Association, Annual Mid-Summer Conference, Detroit.....July 21-24
National Petroleum Association, Atlantic City, Annual Mtg. .....Sept. 16-18
Natl. Safety Council, Chicago, Annual Mtg .....Oct. 5-9
Natl. Metal Congress & Exposition, Cleveland .....Oct. 12-16
American Welding Society, Detroit, Annual Mtg. .....Oct. 12
American Society of Tool Engineers, War Production Conference, Springfield, Mass. .....Oct. 16-17
Natl. Lubricating Grease Inst., New Orleans, Annual Mtg. .....Oct. 25-29
Natl. Industrial Chemical Conf. & Exposition, Chicago .....Nov. 17-22
American Petroleum Inst., Annual Mtg., Chicago .....Nov. 9-13

Press Association

Britain's Newest Bomber

This photograph is one of the first to be released of the Lancaster bomber recently put in service with the RAF. Powered by four Rolls-Royce Merlin XX engines, the plane is the successor of the Avro Manchester, a two-engine bomber driven by the Rolls-Royce Vulture X-24 which is described in this issue.

Speeding up scrap sorting



Information supplied by "Automotive and Aviation Industries"

The prompt, continuous collecting and sorting of scrap salvage, especially of strategic materials, is a matter of vital importance to the war effort. The collection of valuable scrap is comparatively simple, but sorting it efficiently and speedily often presents problems.

In one West Coast airplane factory much of the difficult sorting job is being done by a magnetic separator. Designed to sort 600 pounds of floor sweepings per hour, this machine alone salvages 8000 pounds of small parts each week. Working on the same principle as a fruit-sorting machine, the separator first of all removes non-metallic materials. It then sorts out the ferrous from non-ferrous metals, discharging nuts and bolts from one opening while pouring out rivets from another. Dust and dirt are blown away during the process by a gust of air.

Following the sorting by the separator the salvaged material is inspected at sorting tables and usable nuts, bolts and rivets are reclaimed. The balance is salvaged as scrap material.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.
MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Molybdenum Company
500 Fifth Avenue • New York City

MOLY

"World's Largest Spring"

This spring, mounted on a shop tractor for the Flag Day Parade in Chicago, is 24 ft. long, 44 in. thick, and is made of nine leaves, each five inches thick. If made of steel, it would weigh 112,500 lb.; made of plywood, it weighs 300 lb.

First Annual Meeting Of ACWP Held in Detroit

Donald Nelson, Principal Speaker, Hails Knudsen's Contribution; Macauley Cites Council's Many Achievements

More than 1200 industrialists representing hundreds of automotive companies throughout the nation attended the first annual meeting of the Automotive Council for War Production on July 10 in Detroit. The council, which was formed last January, is a wartime outgrowth of the Automobile Manufacturers Association.

The morning was devoted to trips through war production plants in the Detroit area while the afternoon was given over to a business session, which included talks on subjects relating to the war program. WPB Chairman Donald M. Nelson was the main speaker at the evening session, which was presided over by Ernest C. Kanzler, chief of the automotive branch of WPB. The greatest ovation tendered to anyone, and most of the industry's leaders were present, was that accorded Lieut. Gen. William S. Knudsen, production chief of the War Department. A spontaneous and moving tribute to the former president of General Motors was touched off by Nelson when towards the close of his speech he said.

"I want to pay tribute to the part played by Bill Knudsen in the production program. It has been my pleasure and privilege to work closely with him. There never was a more patriotic and loyal citizen than him. Most of the production we have got today comes from the good, hard, commonsense Bill Knudsen put into the work over the 18 months before I came on the job."

More than 1200 men, who jammed the hotel ballroom to capacity, stood and cheered for nearly five minutes as Lieut. Gen. Knudsen acknowledged their applause.

All officers of the ACWP were re-elected, with Alvan Macauley, board chairman of Packard, continuing as president. Only change in the directorate was the election of C. S. Davis, president of Borg Warner Corp., to a place on the Board. He succeeds W. P. Brown, president of Briggs Mfg. Co., who had resigned.

President Macauley reviewed the accomplishments of the council in the six months since it was formed. He cited the machine tool listing service as the first important cooperative task undertaken. In the half year, he said, almost 250,000 machines were listed in 442 plants of 259 companies. Of these, 66 per cent are now at work on war production, about five per cent are allocated to pending war contracts and seven per cent are working on replacement parts. The remainder, 22 per cent, is available for sale or lease, or for war jobs in their present location.

An index of facilities in the industry's tool shops, according to Macauley, has brought a great saving in conversion time. For example, in less than five hours this service supplied seven major sources capable of executing a Navy job requiring 75,000 manhours. The idle screw machines in a Massachusetts company were taken over by a former producer of spark plugs to do a war job. Exchange of information and mutual aid among producers of like war commodities was pointed out by Macauley as speeding war output for producers of aircraft engines, airframes, military vehicles, tanks, guns and ammunition.

"We are operating now in what may be termed the sub-stratosphere," said Macauley. "We have moved above our

(*Please turn to page* 62)

PUBLICATIONS

A 42-page booklet containing approximately 200 photographs of applications and products has recently been issued by the General Electric Co. to illustrate and describe the wide range of **precision-built equipment** which it offers for the aircraft industry.*

Wheelco Instrument Co.'s Bulletin 26000 is a condensed listing of its complete line of **measuring and control instruments.** The bulletin gives prices and lists numbers of catalog sections for easy reference when full information is required on any item of equipment.*

Leeds & Northrup Co. has just issued a newly revised edition of its **Homo Method for Tempering** catalog. It contains new data and new charts and many new pictures showing how the method is helping to overcome heat-treating bottlenecks in industry's battle for production.*

Merz Engineering Co. has a new booklet, **Where Precision Transcends Every Other Consideration.** It is well illustrated with views of its plant and machine operations and describes the various processes in the production of precision parts, gages, jigs, and machine tools which the company manufactures.*

A new catalog, describing the mechanical features of the **Rex Hi-Discharge Moto-Mixers and Agitators** has just been

(*Please turn to page* 60)

ADVERTISING

E. A. Gebhardt has been elected president of Commercial Advertising, Inc., Chicago.

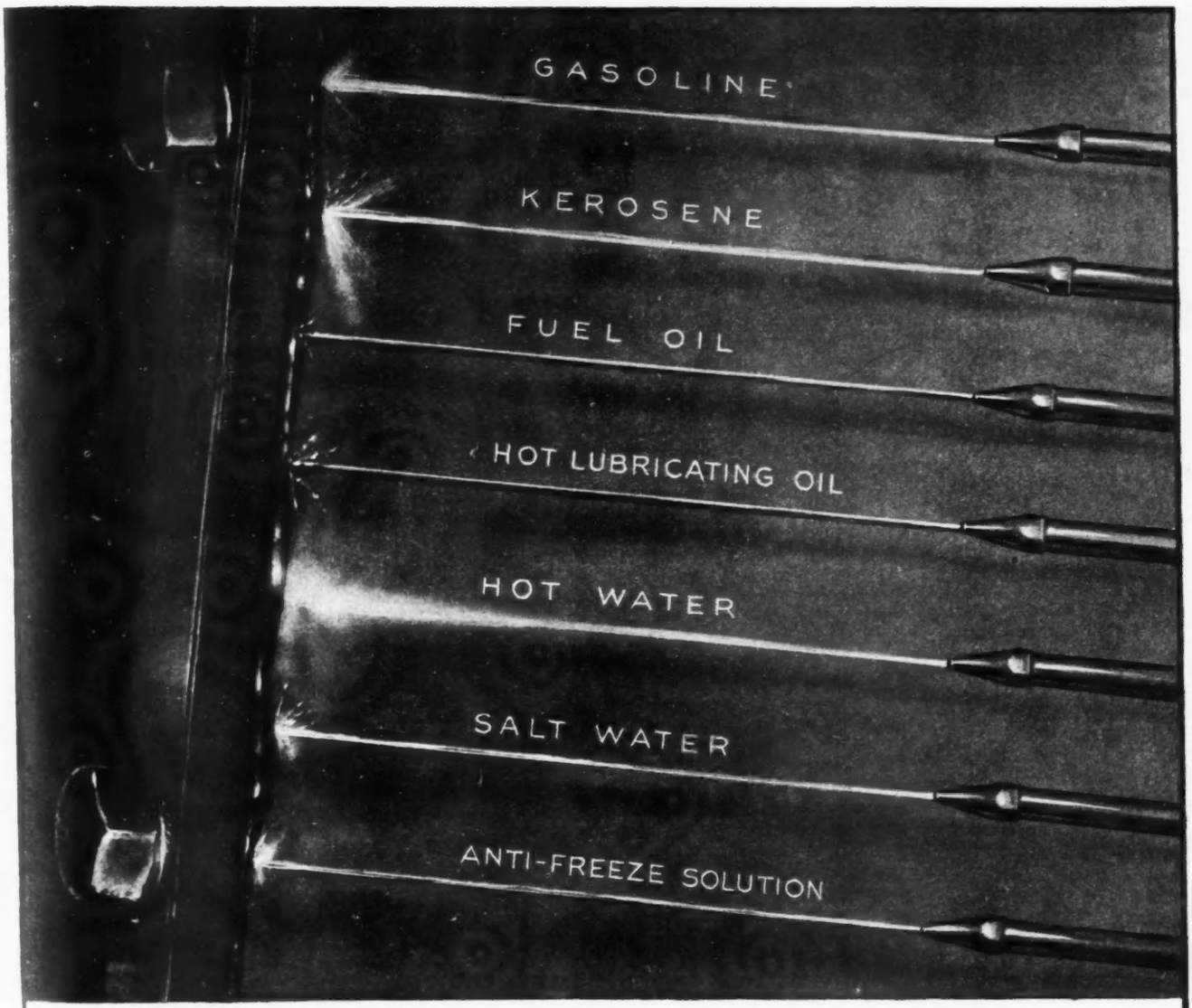
Officers elected by The National Industrial Advertisers Assn. on July 1, for the year 1942-1943 are: president, **Herb V. Mercready,** Magnus Chemical Co.; vice-presidents, **Allen P. Colby,** National Supply Co., **F. L. Lackens,** Hays Corp., **Wilmer H. Cordes,** American Steel and Wire Co., **A. H. Neher,** Century Electric Co., **Harry Keene,** Grinnell Co., **Robert J. Barbour,** Bakelite Corp., **J. A. M. Galilee,** Canadian Westinghouse, Ltd., **H. S. Schuler,** Westinghouse Electric and Mfg. Co.; secretary-treasurer, **Arnold J. Andrews,** Bucyrus-Erie Co.

Change Aircraft Tire Specifications

Issuance of Amendment No. 7 to Supplementary Order M-15-b-1, establishing specifications for the manufacture of airplane tires, was announced early this month by the Director of Industry Operations. The specifications, expected to save 750 tons of crude rubber per year, were approved by the aircraft and rubber branches of the WPB, and various aeronautical agencies.

Midgley Honored

Dr. Thomas Midgley, Jr., discoverer of the anti-knock properties of tetraethyl lead, has been elected an honorary member of the National Academy of Science. Dr. Midgley is chairman of the board of directors of the American Chemical Society and vice-president of the Ethyl Corporation.



IT WON'T BUDGE!

GASOLINE, KEROSENE, FUEL OIL, HOT LUBRICATING OIL, HOT WATER, SALT WATER, ANTI-FREEZE SOLUTION . . . NONE OF THESE LIQUIDS WILL MAKE A FILM OF FORM-A-GASKET MOVE FROM POSITION, MELT OR DISSOLVE!

Permatex Form-A-Gasket used in automobile and aircraft engines is available in three types.

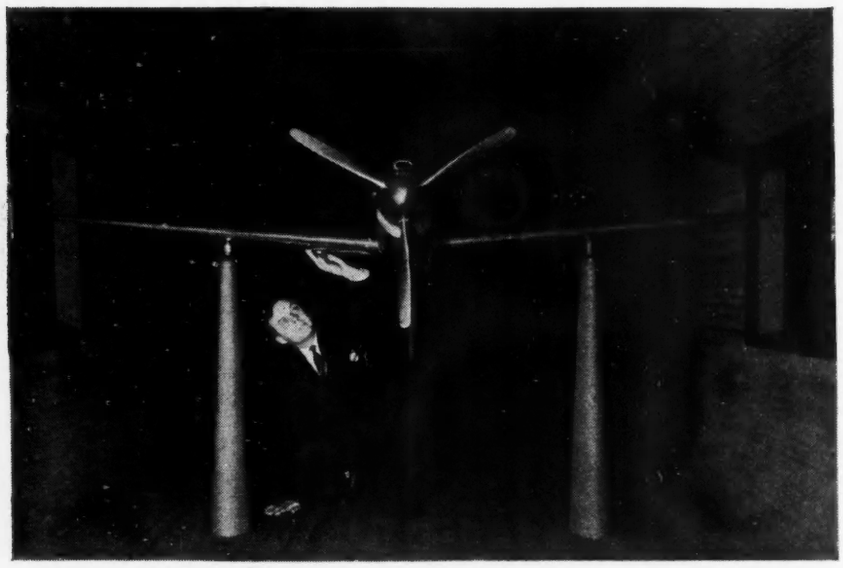
FORM-A-GASKET NUMBER 1 IS A PASTE THAT DRIES FAST AND SETS HARD.

FORM-A-GASKET NUMBER 2 IS A PASTE THAT DRIES SLOWLY AND REMAINS PLIABLE.

AVIATION FORM-A-GASKET IS A HEAVY LIQUID THAT SETS QUICKLY AND DOES NOT DRY.

These three Form-A-Gasket products are used in many industries wherever leakproof, pressure-tight flange unions, gasket assemblies or screw thread connections are required.

PERMATEX COMPANY, INC.
Sheepshead Bay, N.Y., U.S.A.



New North American Wind Tunnel

Under the direction of L. L. Waite, head of the technical section of North American Aviation, a new wind tunnel is nearing completion at the company's West Coast plant. In the photograph Mr. Waite is shown inspecting a one-quarter-size model of a Mustang P-51 fighter in the 7¾- by 11-foot tunnel throat where an air speed of 327 mph can be developed. Air is driven through the tunnel by a seven-blade, 19-foot propeller turned by a 3000-hp. electric motor which runs between 70 and 700 rpm. Means for the measurement of all essential forces through an electro-magnetic balance and the inclusion of several well-placed glass windows add to the general utility of the tunnel.

MEN

(*Continued from page* 52)

who has joined the Army as a first lieutenant.

H. Mansfield Horner, vice president of United Aircraft Corp. and general manager of the Pratt & Whitney Aircraft Division, and **Leonard S. Hobbs,** engineering manager of Pratt & Whitney, have been elected directors of United Aircraft Corp.

Claude A. Crusoe, director of purchases for the Fisher Body Division of General Motors, has been elected president of the University of Detroit Alumni Association.

Brig.-Gen. James H. Doolittle has been awarded the Daniel Guggenheim Medal for notable achievement in the advancement of aeronautics.

T. A. Boyd, head of fuel research for the General Motors Research Division, has been elected second vice president of the Engineering Society of Detroit

Robinson D. Bullard, reclamation engineer for The Bullard Co., has been appointed technical consultant to the Industrial Salvage Section of the Bureau of Industrial Canservation of the WPB. He will assist in preparing a definitive book on industrial reclamation.

H. E. Robinson has been appointed manager of the Strip-Sheet Sales department of Jones & Laughlin Steel Corp., succeeding **A. J. Hazlett,** recently appointed assistant general manager of sales.

Oscar Layman, safety engineer of the Chrysler Corp., has been elected first vice president of the newly formed Michigan Society of Professional Safety Engineers. **R. F. Farnum,** safety engineer of the U. S. Rubber Co., is treasurer.

Norman M. Ross, formerly works manager of Brown-Lipe-Chapin has become general manager of the Brown-Lipe-Chapin Division of the Guide Lamp Division of General Motors at Syracuse, N. Y. which has recently been made a separate division of GM.

Charles A. Mabey has been appointed director of research of The Bristol Co. He has served as physicist for several years with the organization.

Benjamin Sack, formerly executive vice president, has been elected president of Aircraft Screw Products Co., Inc.

G. C. Gridley, formerly vice president and works manager, has been named president and general manager of the Mechanics Universal Joint Division of Borg-Warner Corp., succeeding **E. C. Traner,** who will devote his full time to the presidency of the Rockford Drilling Machine Division. **Arch A. Warner,** former Detroit sales representative, will succeed Gridley as works manager, while other new officers of Mechanics Universal Joint Division are **R. R. Rolph,** former Detroit sales representative as vice president and sales director; **G. A. Shallberg,** secretary, and **W. E. Gustafson,** formerly assistant secretary-treasurer as treasurer.

Harold H. Budds, general manager of Ranger Aircraft Engine Division, and **Alvin P. Adams,** president of Duramold Aircraft Corp., have been elected directors of Fairchild Aviation and Engine Corp. **Duncan B. Cox,** Fairchild vice president, has been named executive vice president of the Al-Fin Corp., a Fairchild affiliate devoted to research on improved cooling of aircraft engines.

C. A. Van Dusen has been named president of Brewster Aeronautical Corp., succeeding George Chaplin, under the voting trust agreement by which the plants were returned to a new management group after operation for a month under government supervision. **Arthur A. Ballentine,** attorney; **James G. Blaine,** president of Marine Midland Trust Co., and **Van Dusen** are voting trustees.

Irving H. Post has been granted a leave of absence as assistant to the executive vice president of N. A. D. A. to enter the U. S. Army as a lieutenant-colonel. He will be succeeded by **Frank Breen.**

Doing More

(*Continued from page* 17)

needed work done by tools which are already in existence.

Weapons and munitions are articles which, in the very nature of things, have always previously been made on a basis completely different from the basis on which ordinary commercial goods are made. They are made to very rigid and exact specifications. They are designed to do specialized jobs in which failure to perform properly can have disastrous results. Consequently, they are not commonly designed with speed or ease of manufacture in mind, nor are they designed so as to conserve materials. They are designed to do a job and everything else has to be secondary to that one controlling thought. They have to be designed that way if the men who fight with them are to fight successfully.

But we are now taking those carefully-designed articles and turning them out on a mass production basis. Furthermore, we are obliged to make such enormous quantities of them, that we are in grave danger of running short of material, and therefore we have got to find ways of making the maximum quantities of arms and munitions out of minimum quantities of material—and making them faster that we ever dreamed of making them before.

I feel that the greatest single contribution which the automotive industry will make to our war effort will come right in that connection. One of the finest things I have seen in our war program is the way in which the men of this industry—from engineers and executives all the way down to the men at the benches—have applied their knowledge of machines and materials, their "know how" in the mass production field, to this very difficult task of getting speedy volume production of munitions. I do not, of course, mean for a moment to imply that the same thing is not being done by other industries. Perhaps I speak with so much feeling about the job that is being done in your industry because I have a little more first-hand knowledge about this particular case than I have of some others.

That word "ingenuity" is the key word all the way through. You men have been extremely ingenious in adapting your industry to war production, ingenious in finding ways to make an old machine do the job instead of getting a new one specifically made for the purpose, ingenious in saving material by cutting down on the size of the casting that goes to be machined, ingenious in working out simple little steps to save labor and machine time in the fabrication of complicated bits of war materiel. If I could give you just one message tonight I would like to say continue to be ingenious. Never for a moment let up in your search for ways of doing more, faster, with less. You have the chance to revolutionize the whole art of producing for war

Milwaukee Rotary Head Milling Machine

KEARNEY & TRECKER
CORPORATION
Milwaukee
MILLING MACHINES

The Milwaukee Rotary Head Milling Machine, primarily developed for tool and die making, is increasingly being used to meet peak production demands on a variety of milling operations. Fast — versatile — flexible — it performs layout, milling, drilling, precision boring and slotting operations with improved accuracy and usually decreases costs.

KEARNEY & TRECKER CORP., MILWAUKEE, WIS., U. S. A.

Milwaukee MILLING MACHINES

Parts Output

(*Continued from page* 50)

has been a shortage of certain forged parts due to inability to get forging capacity to make a short run on such parts. Where passenger car and truck manufacturers purchase their spare parts from parts suppliers, the shortage has been aggravated by lack of material and use of manpower and machines on war work, in some cases 100 per cent.

Manufacturers are hopeful that they will be granted a high priority rating for material for functional replacement parts under the Production Requirements Plan. It has been intimated that their PD-25-A applications for materials for parts manufacture will be expedited by the Production Requirements Section of WPB. The government appears to realize that it is imperative that possibly 20 million of the nation's motor vehicles must be kept in operation in order to prevent a breakdown in the national economy.

However, the materials situation generally appears to be growing more acute. The July 1 report of the Bureau of Industrial Conservation of WPB lists among the most critical materials the following that have important uses in replacement parts manufacture: aluminum, brass, copper, nickel and nickel alloys, tin, tungsten, alloy steel, crude rubber, and synthetic rubber. Substitutes have been worked out for some of these materials, but alloy steel, copper, aluminum, and crude rubber are indispensable in certain uses. Lead, employed in bearings and solder, is becoming more available. The situation in brass, on the other hand, is tighter. The copper and brass shortages are especially felt in replacement radiators and bearings, although steel fin radiators are working out experimentally with some manufacturers.

Exhaust valves are handled under a separate order, L-128, effective July 1, which specifies that all manufacturers must use a two-piece welded head type of construction, with chromium and nickel to be used in the valve head only. Certain percentages are specified for valve heads, those for passenger cars and light trucks being granted 9 per cent chromium, those for medium and heavy trucks allowed 21 per cent chromium and 1½ per cent nickel, and those for medium and heavy trucks with over 300 cubic inches piston displacement being allowed 20 per cent chromium and 9 per cent. nickel. A used exhaust valve must be turned in with each replacement and this is disposed of as scrap. Valves for medium and heavy trucks cannot be used in passenger cars or light trucks. However, there is little likelihood of the manufacture of valves for civilian use in the near future due to the complete war-time allocation of chromium and nickel. Civilian users must rely on refacing and reconditioning of old valves and the present stocks of manufacturers and dealers.

Greatest burden under the new parts order L-158 probably will fall upon the retail dealer. Under further inventory limitations, a distributor in the eastern or central time zones cannot have an inventory of replacement parts in excess of a 60-day supply, which is equivalent to two-thirds of his total sales in the preceding quarterly period. Nor can he order more than a 30-day supply of replacement parts. A distributor in any other time zone, including the Mountain and Pacific Coast areas, cannot stock more than a 90-day supply of replacement parts, equivalent to total sales in the preceding quarterly period, nor order more than a 45-day supply. These inventory limits go into effect Aug. 15. They are similar to those in order L-63, which imposes similar limits on automotive supplies but from which functional replacement parts as described in order L-4-c were excluded.

A distributor, by definition of Order L-158, is any person not a producer whose business consists in whole or in part of the sale of replacement parts from inventory, including wholesalers, jobbers, dealers, retailers, and others performing a similar function. It is believed that fleet truck operators that maintain spare parts banks may come under this definition.

With each replacement parts order that he sends to the manufacturer or supplier, a distributor must enclose a certificate of compliance with Order L-158 by which he certifies that the purchase does not exceed the limitations imposed under the inventory provisions of the order. This will work a hardship on the retail automobile dealer, who has had to cut his expenses to the bone under the restrictions imposed on his business by automobile, truck, gasoline, and tire rationing. The clerical work involved in inventory control under this order is considerable.

The dealer also will have to bear the burden of receiving worn parts and determining whether they can be reconditioned or not. If they are good only for scrap, he must direct such scrap into the proper salvage channels.

A distributor may accept delivery of specific items of replacement parts even if his maximum permissible inventory will be exceeded, if that is necessary to bring his inventory of those specific items up to the dollar value equal to the sales of such items from inventories during the preceding month. This is in order to maintain balanced inventories and to permit a dealer to stock certain vital parts whose absence from stock would handicap the car owner who depends upon him for service. If a vehicle is immobilized for lack of a replacement part, the distributor can send through a certificate of emergency order giving the engine number of the disabled vehicle and the fact that it cannot be operated without the particular part. A producer or distributor must give such orders precedence in shipment.

Wildcat Strikes

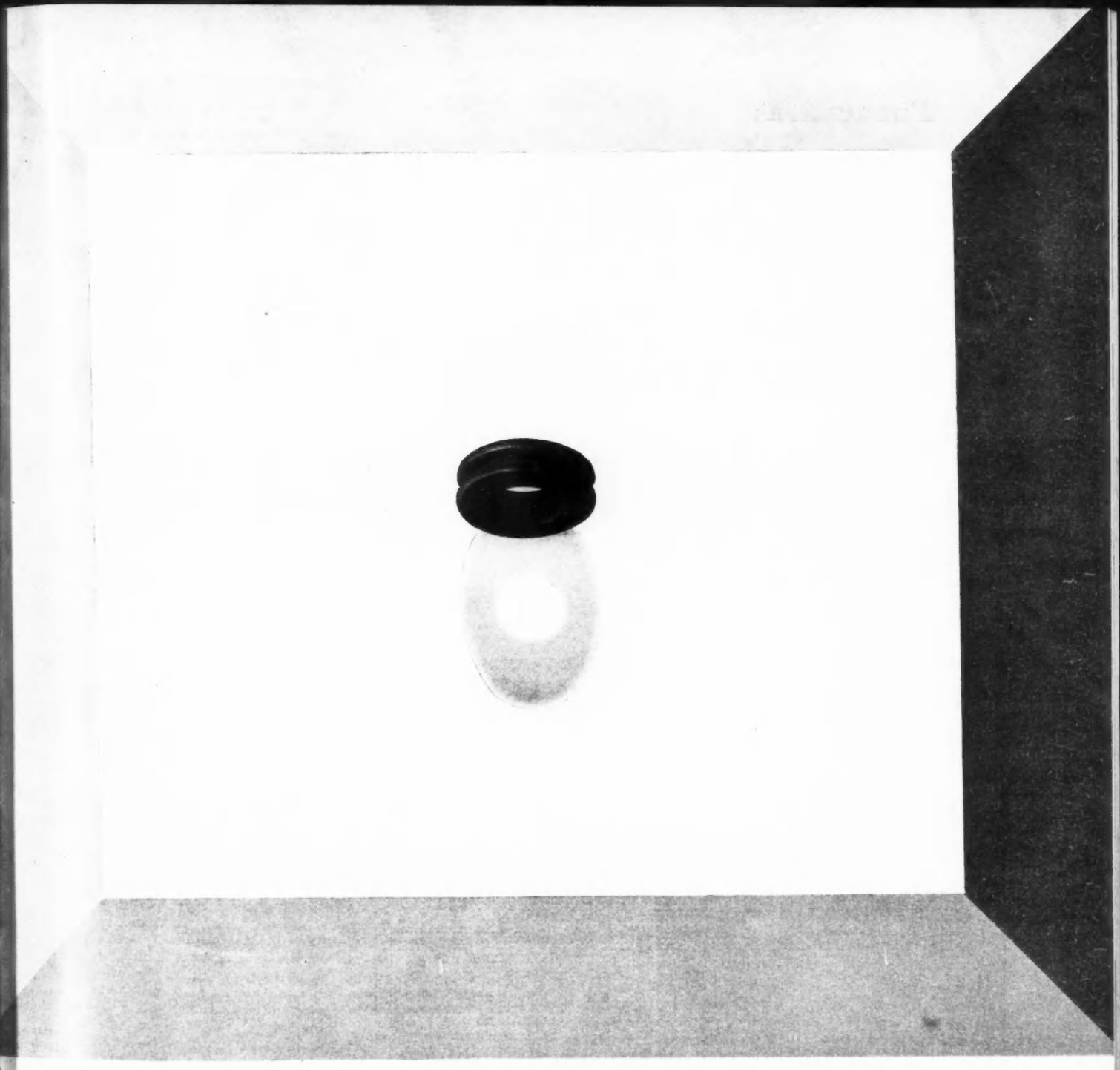
(*Continued from page* 51)

mendations from the three-man mediation panel of the War Labor Board in their dispute over a new contract. In a brief filed with the panel, the UAW-CIO declared that the GM wage rate is at least 8 cents an hour less than Ford's hourly rate. The brief pointed out that Ford's average hourly rate for 137 classifications was $1.274, and that of Continental Motors Corp. for 47 classifications was $1.276, while Cadillac's average for 177 classifications was $1.112 and Buick's rate for 127 classifications averaged $1.10. The union justified the higher wage rates in the automotive industry by the industry's productive efficiency and its capacity for profit. The union also cited the increased cost of living between April, 1941, when GM workers were granted a 10-cent-per-hour raise, and April, 1942. During the year living costs increased 14.5 per cent in Detroit, 15.9 per cent in Flint and 12.9 per cent in Lansing, according to the U. S. Bureau of Labor Statistics.

Meanwhile, the two other major automotive labor disputes have been certified to the War Labor Board but the GM decision is likely to provide the pattern for their settlement. After negotiations for a new contract replacing that which expired June 20 had stalemated following three weeks of conferences, the dispute between the UAW-CIO and the Ford Motor Co. was referred to the WLB June 25 on recommendation of James F. Dewey, federal mediator. Ford is opposed to continuing the union dues checkoff but the company agreed to a proposal by the board that the present contract be extended until Aug. 1. The dispute between Chrysler Corp. and the UAW-CIO over a new wage contract to replace the one that expired June 1 also was certified to the WLB June 30. Negotiations had been in progress little more than two weeks. In a statement of issues presented to the WLB, Morris Field, co-director of the Chrysler Department of the UAW-CIO, said that the wage rates set for new jobs in classifications created by conversion to war production were lower than those paid in other plants in the area. This consequently resulted in restlessness, dissatisfaction, and migration to other plants by Chrysler workers. A Chrysler spokesman denied this charge. A panel of the WLB will hear the Chrysler dispute in Washington July 15.

S. T. Thompson

S. T. Thompson, vice-president, Zenith Radio Corp., Chicago, Ill., died early in June after a month's illness due to a streptococci infection. At one time, Mr. Thompson was general manager of the Duplex Governor Co., a prominent producer during World War I.



Multiply it by 100,000,000

AMERICA'S men-of-war and machines for war production are swallowing stamped and molded Thiokol* synthetic rubber parts at the rate of 100,000,000 per year. The different jobs these tremendous trifles are doing can't be counted—but their importance to victory *can!*

Often permanently immersed in gasoline, oils and greases . . . frequently exposed to burning sunlight and severe oxidation . . . millions of Thiokol* synthetic rubber parts are giving lasting service where many other materials fail. In other cases the use of Thiokol* synthetic rubber is conserving our natural rubber stockpile.

In cooperation with rubber technicians and Government authorities Thiokol Corporation is today occupying itself only with the development of uses of Thiokol* synthetic rubber directly connected with the war. Thiokol Corporation, Trenton, New Jersey.

Thiokol

SYNTHETIC RUBBER

"AMERICA'S FIRST"

*Thiokol Corporation trade mark reg. U. S.

Publications

(*Continued from page* 54)

issued by Chain Belt Co. The catalog also contains complete specifications and operating data.*

Caterpillar Diesels Go to War is the title of a new booklet by Caterpillar Tractor Co., giving descriptions and illustrations of combat and non-combat use of Caterpillar products.*

A data manual of 40 pages covering all essential phases of cleaning required in aircraft production and maintenance has just been issued by **Oakite Products, Inc.** Among production operations discussed are safely cleaning aluminum alloy parts before resistance spot welding; preparing aluminum, magnesium and their alloys for anodizing or other protective surface treatment, etc. In addition, the manual also reviews a wide range of production equipment maintenance and plant housekeeping work common to aircraft and accessory manufacturing plant.*

A new catalog section on its **Vulcalock Rubber Linings** for handling corrosives and abrasives has been published by The B. F. Goodrich Co.*

A new 8-page bulletin just issued by The Watson-Stillman Co., presents its line of **high-pressure motor-driven vertical pumps,** including a simplex, duplex, and triplex types in a wide range of models and capacities.*

Shure Bros. has just issued a new catalog designed to aid in the proper selection of **microphones** for various war and vital civilian applications. Technical data is given on Shure Dynamic, Crystal, and Carbon Microphones for use in ordnance plants, Army camps, etc.*

Protection to shipments of war products including ammunition carriers, crated warplanes, food, lumber, etc., are featured in the current issue of Acme Process News No. 7—issued by Acme Steel Co.

Carlton **miniature incandescent lamp bulbs** are described and illustrated in a new booklet by Carlton Lamp Corp. A price list of bulbs, together with selection tables for automotive, aviation, marine, safety and auxiliary service, and miscellaneous service, are included.*

An attractive booklet has been issued by Belle City Malleable Iron Co., commemorating its 50th anniversary. It contains many photographs of production operations in the plant and information regarding the history of malleable iron castings.*

Aircraft Screw Products Co.'s catalog No. 5 contains information and specifications on its **Aero-Thread screw thread system.***

Reading Chain & Block Corp.'s catalog on **Traveling Cranes,** describes the product and unit parts such as trolleys, end trucks, gears, and cabs.*

* Obtainable through editorial department, AUTOMOTIVE *and* AVIATION INDUSTRIES. Address: Chestnut and 56th Sts., Philadelphia. Please give date of issue in which literature was listed.

HOW TO DESIGN AND GRIND CHIP BREAKERS FOR CARBIDE STEEL-CUTTING TOOLS

Since Carboloy tools operate at speeds usually several times faster (generally in excess of 200 F.P.M.) than high speed steel tools, the problem of economical, safe, chip disposal is one that must be considered when employing carbides for cutting steel. Ordinarily, when machining steel, a continuous chip is produced. Easy chip disposal requires that this continuous chip be broken into relatively short lengths that can be readily removed from the machine. The most widely used type of chip breaker for this purpose is the ground-in step-type breaker.

A general guide to the design and grinding of this type is shown below. Further details are contained in the 32 page Carboloy Tool Manual, available free upon request.

9 Styles of Standard-Stock Tools Available for Cutting Steel

Carboloy Standard Tools—stocked for prompt delivery—include nine styles furnished in grades for cutting steel. Adaptable to 80% of all turning, boring, facing jobs, Carboloy standards can be quickly converted—in your tool grinding room—to special shapes required. One large mid-western plant, for example, uses just 9 Carboloy standard styles for 89% of all carbide tool applications in the plant. This standardization has resulted in lower tool inventory, reduced tool costs, and has enabled them to get carbide tools on the job *fast*. No delays awaiting deliveries of special shapes . . . they make their own specials by adapting standards.

Here is a typical example: Machining cast steel reduction gear blanks for the main drive of destroyers (see cut) .14 specially shaped tools required. Ordinarily that means several weeks of waiting. But this plant takes just four styles of Carboloy standards from their stock, grinds them to the 14 special shapes in an average time of less than 10 minutes per tool!

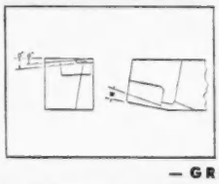
In this emergency period—when every minute counts—Carboloy Standard Tools, more than ever before, are of utmost importance to your plant. Send for catalog GT-140-R.

One user "makes" 14 special carbide tools for this job in less than 10 minutes per tool

— DESIGN HINTS —

◀ At the high cutting speeds common with Carboloy tools, chips present a problem in safe, economical disposal.

The ground-in step ▶ is the most widely used type of chip breaker. Recommended for practically all kinds of steel cutting jobs.



RECOMMENDED WIDTH OF CHIP BREAKER (W)

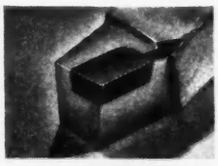
Feed In. Per Rev.	.008-.013	.013-.017	.018-.022	.023-.027	.028-.033
Depth Of Cut Inches	1/64 - 3/64	1/16	5/64	3/32	7/64	1/8
	3/64 - 1/16	3/32	1/8	5/32	9/64	5/16
	5/64 - 1/8	1/8	5/32	3/16	11/64	7/32
	1/16 - 3/16	5/32	3/16	7/32	13/64	1/4

NOTE: A chip breaker depth of .020 is satisfactory for most types of steel

◀ **In step-type chip breakers, it is desirable to have same rake angle on both the top surface of tip, and chip breaker.**

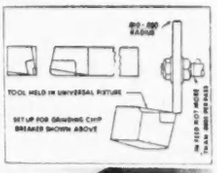
▲ **Usually adjustments only in width of breaker are necessary. This table is general guide to correct widths for various feeds and depths of cut.**

— GRINDING HINTS —



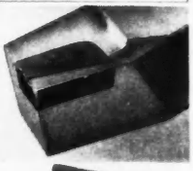
◀ Make sure that all tool angles have been rough and semi-finish ground to desired shape, and steel shank relieved behind tip.

Then set up tool in ▶ universal vise on a cutter, surface or chip breaker grinder. Use a 100 grit resinoid bond diamond wheel.



◀ Use kerosene or soluble oil, applied with wick, to keep diamond wheel open. Grind full width of breaker. Use down feed not exceeding .0005 per pass.

Finish grind tool ▶ shape after breaker is completed. This removes any minute nicks developed during breaker grinding.



Send for free 32-page Carboloy Tool Manual

CARBOLOY COMPANY, INC.

11153 E. 8 MILE RD., DETROIT, MICH.

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CARBOLOY CEMENTED CARBIDES

TOOLS · DIES · DRESSERS
CORE BITS · MASONRY DRILLS
· WEAR RESISTANT PARTS ·

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FOR THE MANUFACTURING · MINING · TRANSPORTATION · CONSTRUCTION INDUSTRIES

Alloy-Lean Steels

(*Continued from page* 52)

especially when thoughts turn to next winter's supply, is becoming more and more aggravated. Some scrap dealers are reported to be sweetening profits by selling sheared plate ends not as scrap, but as plate.

With steel plate perhaps the scarcest of all descriptions of finished steel, such transactions, even if no large tonnage is entailed, are certain to arouse resentment among hundreds of consumers whose patience is being sorely tried by the long delays in having their orders filled. There are more reports of interruptions of operations to permit repairs of mill equipment, that can not be postponed, but on the whole an infinitesimal amount of production is being lost because of this, a surprisingly high rate of maintenance efficiency having been attained in the steel industry. Fewer repairs are necessary and these are made in much less time than formerly.

News from Washington that the Bureau of Mines plans to construct two pilot plants for the production of sponge iron as a means of relieving the scrap iron shortage, is meeting with a "wait and see" attitude in steel circles. Experimental sponge iron plants have been erected and later discarded, but some of the large steel companies, which footed the bills for these unsuccessful trials, are only too willing to be convinced that their experience was not conclusive and that the supply of ferrous material can be augmented by the sponge iron process or any other means of auxiliary production.

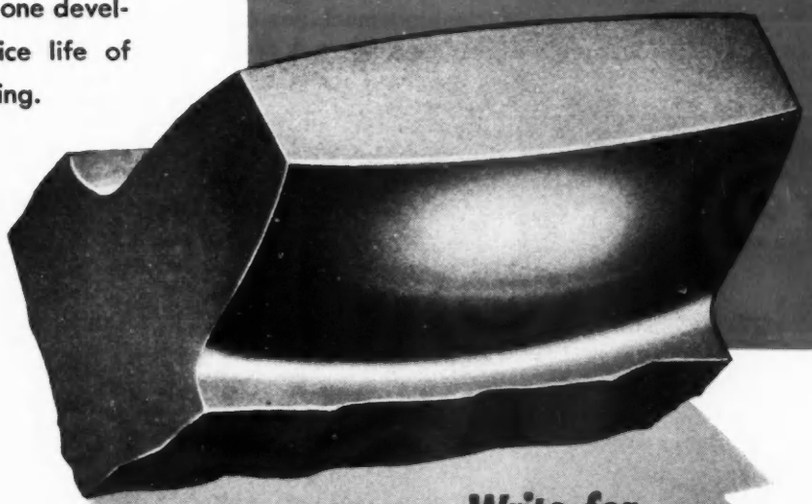
Tungsten has been put under further allocation and end-use control by WPB. Vanadium conservation measures have also been extended.

MAGNAFLUX TEST *proves* SUPERIORITY OF SHAVED GEARS

Red Ring Rotary Shaving finishes gear tooth surfaces accurately—faster than other methods and without producing any of those microscopic cracks in the tooth surface which are so hard to avoid with other gear finishing methods—and which are so prolific of fatigue failures in service. A Magnaflux test on shaved aircraft gears shows this conclusively.

This Patented Rotary Shaving Process which provides the Elliptoid Tooth Form has done more than any other one development to increase the service life of gears by eliminating end bearing.

Red Ring Shaving is an automatic process that is fast and economical. No skill is required in machine operation. It may, but need not, be followed by Red Ring Crossed Axes Lapping.



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NATIONAL BROACH AND MACHINE CO.
RED RING PRODUCTS
5600 ST. JEAN · DETROIT, MICH.

SPECIALISTS ON SPUR AND HELICAL INVOLUTE GEAR PRACTICE

ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

ACWP Meeting

(*Continued from Page* 54)

previous ceilings in value of output, in employment, in man hours and machine-hours of accomplished work. The record demonstrates now that we are technically equipped to climb tremendous distances into the industrial stratosphere. The real problems that will close around us and immediate attainment of the utmost output are those of supply. This industry unquestionably faces difficulties in finding the necessary man-power. Greater still is the question of raw materials. Nevertheless . . . already substitutes have replaced many vital materials, manufacturing processes have been simplified without sacrifice of quality and an intensive salvage drive is under way."

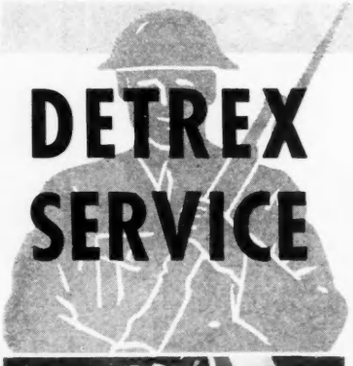
"To date the United States has spent nearly $40 billions for the war effort," Robert R. Nathan, chairman of the planning commission of WPB, told the council, "only part of which has reflected finished fighting material. Only in recent months have we seen a substantial flow of tanks, artillery combat planes, ammunition and other weapons. Before we can be optimistic about the outcome of this war we must have accumulated a store of munitions which will fill all of the pipelines from the first assembly line to the last fighting outpost."

"The job the automotive industry is doing is the best possible proof that the American free enterprise system, often attacked, sometimes abused, is fundamentally the best system ever devised," Gov. Murray D. Van Wagoner, of Michigan, asserted at the annual dinner. In the ranks of men of vision and of action who have influenced the course of world history, he said, the men of the ACWP will go down in history as front line defenders of the democracy that is going to triumph in this war.

The automotive industry is producing war equipment at a rate of $12 millions worth per day, Paul Garrett, vice president of General Motors, told the council. It accomplished the changeover from peace to war production with a maximum drop in employment only 12½ per cent below the December level.

"We won't be in this war so very long before our armed forces and their allies will have almost half as many American vehicles as there are trucks registered in the entire U. S.," I. B. Babcock, president of Yellow Truck & Coach Mfg. Co., told the meeting. (A total of 4,911,500 trucks were registered in the U. S. as of December 31, according to estimates). U. S. plants were producing more than 1000 military vehicles per day before Pearl Harbor, Babcock stated, and this output has been further increased.

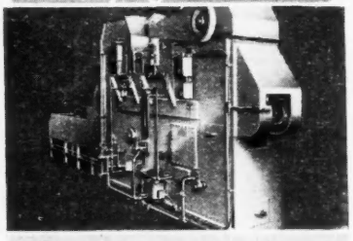
A new production information service was announced that will pass along manufacturing short cuts and improved industrial methods developed by individual companies to other ACWP members. William F. Sherman, Detroit Editor of *Iron Age*, will have charge of this new council service, compiling and editing the production information reports. The service, which will begin August 1, will be an extension of the work of the ACWP War Products Division.



DETREX SERVICE

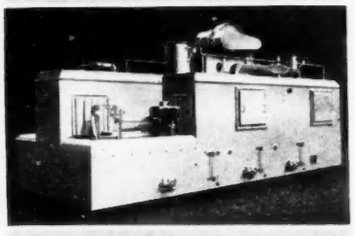
Guards The Efficiency

Of Your METAL CLEANING OPERATIONS



Special vapor spray vapor degreaser used for the cleaning of small shells.

Detrex Service Men cooperate with and instruct the operators, engineers, and chemists to whom you have assigned the responsibility of your metal cleaning . . . they show how solvents may be used most economically . . . demonstrate how cleaning machines should be operated and how the work can be handled to best advantage.



Washer designed for the cleaning of aircraft engine cylinders.

Such factors as draft elimination, heat balance, proper spraying of solvent, and many other important details of correct operation and maintenance are covered thoroughly.

To get the most for your "metal cleaning dollar", you are urged to take advantage of Detrex Service. This service is available at all times.

DETREX MANUFACTURES Degreasers using stabilized safety solvents, Perm-A-Clor and Triad . . . Detrex Machines for Alkali, Spirits and Emulsion Cleaning . . . Detrex Processing Machines . . . and Triad Compounds, Strippers and Emulsion Cleaners.

SOLVENT DEGREASING and ALKALI CLEANING

DETROIT REX PRODUCTS COMPANY

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40 YEARS AGO

A bill has been introduced into the House of Commons to render compulsory the registration of all motor vehicles and the exhibition upon them of some means of identification. It is suggested that only a nominal fee shall be charged, as the automobilists, in common with all other carriage owners, contribute to the excise in respect of their vehicles. The bill is receiving the support of the Automobile Club and of many motoring Members of Parliament, for it not only proposes what would seem to be something of a hardship, but also includes a clause abolishing the present authorized speed limit, which by statute is 14 miles an hour, and, by order of the Local Government Board, has been further reduced to 12 miles an hour. The bill, therefore, is of the nature of a compromise. . . .

From THE HORSELESS AGE, July 16, 1902.

Six Time and Money Saving Reasons Why It Will Pay You To Install SUNNEN PRECISION HONING

1. ***Inexpensive*** . . . The basic price of the Sunnen Precision Honing Machine is only $195. Operating costs are correspondingly low.

2. ***Accurate — Super-Smooth Finish*** . . . Accuracy within .0001″ is guaranteed —has often been held to .000025″ in production work. Finish often held to 2 to 3 micro inches.

3. ***Does Not Require Skilled Labor*** . . . Workers in "teens" can handle jobs in "tenths" after a few hours' instruction and practice. In many plants Sunnen Hones are operated by girls.

4. ***Relieves Big Internal Grinders*** . . . Range of .185″ to 2.400″ makes it possible to handle many important small jobs which in the past had to be run on large internal grinders.

5. ***Doesn't Need Fixtures*** . . . Work is held in hand by operator — no fixtures necessary.

6. ***No Set-Up Time*** . . . Machine can be set up for any job within its size range in less than one minute. Size adjustment can be made with machine in motion and work on mandrel.

Write for **FREE BULLETIN**

WRITE for Free Bulletin giving complete data. Or, if you prefer, a Sales Engineer will call and demonstrate machine in your plant on your job.

★Manufacturers throughout the war industries are amazed to find that such an inexpensive machine can produce such accurate work at so low a cost.

In our constant effort for more and MORE PRODUCTION of vital war materials, the Sunnen Precision Honing Machine is playing an important part. In plant after plant it is showing production increases of from 100% to 500% with corresponding reduction in costs.

Corrects errors of out-of-roundness and taper caused by previous operations. Finishes holes to close tolerances both as to size and straightness. Maintains alignment established by previous operations. Provides simple, low cost method for duplicating sizes.

Put Sunnen Precision Honing to work in your plant.

SUNNEN PRODUCTS COMPANY

7915 Manchester Avenue St. Louis, Missouri

Canadian Factory: Chatham, Ontario

SUNNEN

Aluminum Aircraft Link "produces high finish without bell-mouthing."

Better finish and alignment maintained on yoke for compressor.

Mild Steel Clevis Honing was used to correct errors of previous machining and maintain true alignment of the two bearing surfaces of this clevis.

Hardened Steel Inner Bearing Race honed to .00005″ limit. Surface finish improved; errors of out-of-roundness eliminated.

Bronze Valve. The Sunnen method of honing is used to secure a high finish and accuracy.

Diesel Engine Fuel Injector Cylinder "So accurate that a piston can be fit within .00005 inch."

NACA Research Facilities

(*Continued from page 27*)

Moffett Field at the time the report was issued were a 16-ft high-speed tunnel and two 7 by 10 ft high-speed tunnels, while a low-turbulence, high-speed tunnel, a supersonic tunnel, and a full-scale tunnel were still under construction. Langley Field's new projects include a second seaplane towing tank, a seaplane impact basin and extensions to the Flight Research Laboratory.

Illustrations of some of the NACA wind tunnels are shown herewith. In the 7 by 10 ft wind tunnel for research work on stability and control the jet is completely enclosed and is so arranged that model wings and model airplanes having a span of up to 8 ft can be tested. A short length of a large-scale wing can be mounted vertically in the jet to determine the characteristics of the airfoil section under conditions approaching those of actual flight. The fan is a six-blade adjustable-pitch propeller of 10.5 ft diameter, and is driven by a 200-hp d.c. motor with which a maximum air speed of 90 mph may be obtained. The tunnel is equipped with a six-component indicating balance on which the forces and moments may be measured directly and independently.

The 19-ft pressure wind tunnel is used for testing airplane models at high speeds in air of super-atmospheric density, to approximate full-scale conditions.

One of the illustrations shows the test section of the 12-ft free-flight wind tunnel, with a dynamic-scale model of a modern fighting plane in free flight. This tunnel is used to study control and stability characteristics of airplane models in flight. The model is flown by means of controls which are operated by electric power by means of fine wires connected to it. Changes in the models to improve their flying characteristics can be made rapidly in this tunnel, and such laboratory tests save considerable expense and hazardous test flying of the actual plane when completed.

In the free-spinning wind tunnel, dynamic scale models of modern airplanes are tested to determine their spinning characteristics and their ability to recover from spins through movement of the control surfaces. From information obtained from such a test the spin-recovery characteristics of the full-scale plane may be predicted. Adjacent to the free-spinning wind tunnel in the photograph is shown a large sphere, 60-ft in diameter, which houses the NACA 12-ft free-flight wind tunnel of which an interior view is shown by another photograph.

Victory DEMANDS MORE ARMAMENT PRODUCTION

JESSOP HIGH-CARBON HIGH-CHROME DIE STEELS CAN HELP You!

★ ★ ★

More production of higher quality is one effective way to serve the National War Effort.

Performance records show Jessop High Carbon-High Chrome Die Steels speed production in metal forming and die operations—and results count now more than ever before.

Moreover, Jessop High Carbon-High Chrome Die Steels conserve die steel by producing more pieces per grind. Other advantages include less time required for die set-up and maintenance, which saves die makers time and eases the burden on die making machines and grinding equipment.

Write for descriptive literature.

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General Offices
WASHINGTON, PENNA., U. S. A.

JESSOP STEELS FOR AMERICA AND HER ALLIES

CARBON · HIGH SPEED · SPECIAL ALLOY · STAINLESS · COMPOSITE STEELS

Dr. Graham Edgar, Director of Research of the Ethyl Corp., who delivered the seventeenth Edgar Marburg lecture at the recent ASTM annual meeting in Atlantic City. Referring to probable developments in motor fuels, Dr. Edgar ventured the guess that after the war gasoline approximately equivalent to the premium grade of 1941 (say 80 octane number) could be produced as a house-brand gasoline, and that premium gasoline having an effective anti-knock value of between 90 and 100 octane number could be produced.

"You can if you will"

THEODORE ROOSEVELT

All of us, when the occasion demands, find hidden resources within us—resources that help us overcome many seemingly impossible obstacles.

Today, new and greater demands are being made on all piston ring manufacturers. New designs, new metallurgical formulas, and greater piston ring strength are needed. Today—because necessity would not take "no" for an answer—the finest piston rings ever built are being made.

Sealed Power is building these new and better rings.

It's the old, old story. Theodore Roosevelt said it this way: "You can if you will."

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SEALED POWER CORPORATION

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SEALED POWER PISTON RINGS

Vidal Process

(*Continued from page* 29)

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The Vidal Research Corp. was organized to develop the method of fabricating parts by this process. It will not do any manufacturing itself but will license manufacturers to use the process in their plants, and it will extend aid to licensees by working out the details connected with any particular application. Licenses have already been granted to a number of firms, most of which plan to make parts for aircraft manufacturers. One of these is Universal Molded Products Corp., which is essentially a merger of furniture manufacturers with plants in Virginia and North Carolina. This firm set up a plant and started work on bomber parts, of which many thousand have been shipped already, we understand. Another licensee is the Allied Aircraft Corp., with a plant located near Baltimore. One of the projects on which that firm is working is a large transport glider capable of carrying twelve men with complete equipment. The molds for this ship contain more than a carload of lumber. To cure the fuselage of this ship required a tank about 9 ft. high and about 60 ft. long, and as it was found impossible to get one built, use was made of a large fumigator used by the New York Port Authority for fumigating bales of imported cotton.

The Vidal process, of course, can be used for the fabrication of many other articles besides aircraft parts, although, on account of the present emergency, more attention has been given to such parts than to any other product. Special types of automobile bodies of which a limited number are required might well be made by this process, because the cost of wooden forms required is insignificant as compared with that of metal dies. In fact, we learn that some station wagon bodies have already been built. The process also lends itself well to the production of light boats, and we are told that the United States Plywood Corp., another licensee under the Vidal patent, has built about 1500 pleasure boats and several hundred special boats for the Government. Another special product made of plywood by the Vidal process is a detachable fuel tank for airplanes.

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JOHNSON BRONZE

The BEARING *that* LUBRICATES *itself*

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SELF LUBRICATING
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Oil is the life blood of every motive unit. In order to gain smooth, quiet operation; long, satisfactory bearing life, we must have the right amount of oil . . . in the right place . . . at the right time.

Johnson LEDALOYL bronze bearings provide this type of performance. Evenly distributed over all surfaces of every LEDALOYL bearing are millions of tiny, evenly spaced pores. Each of these pores serve as miniature oil reservoirs. Heat, generated by the turning of the shaft draws the oil from the pores into the bearing area. Thus a thin, protecting film of lubricant separates the shaft from the bearing, reduces friction to a minimum and assures long, satisfactory life. When the shaft stops, the oil is absorbed by the bearing.

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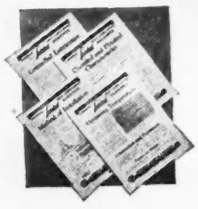

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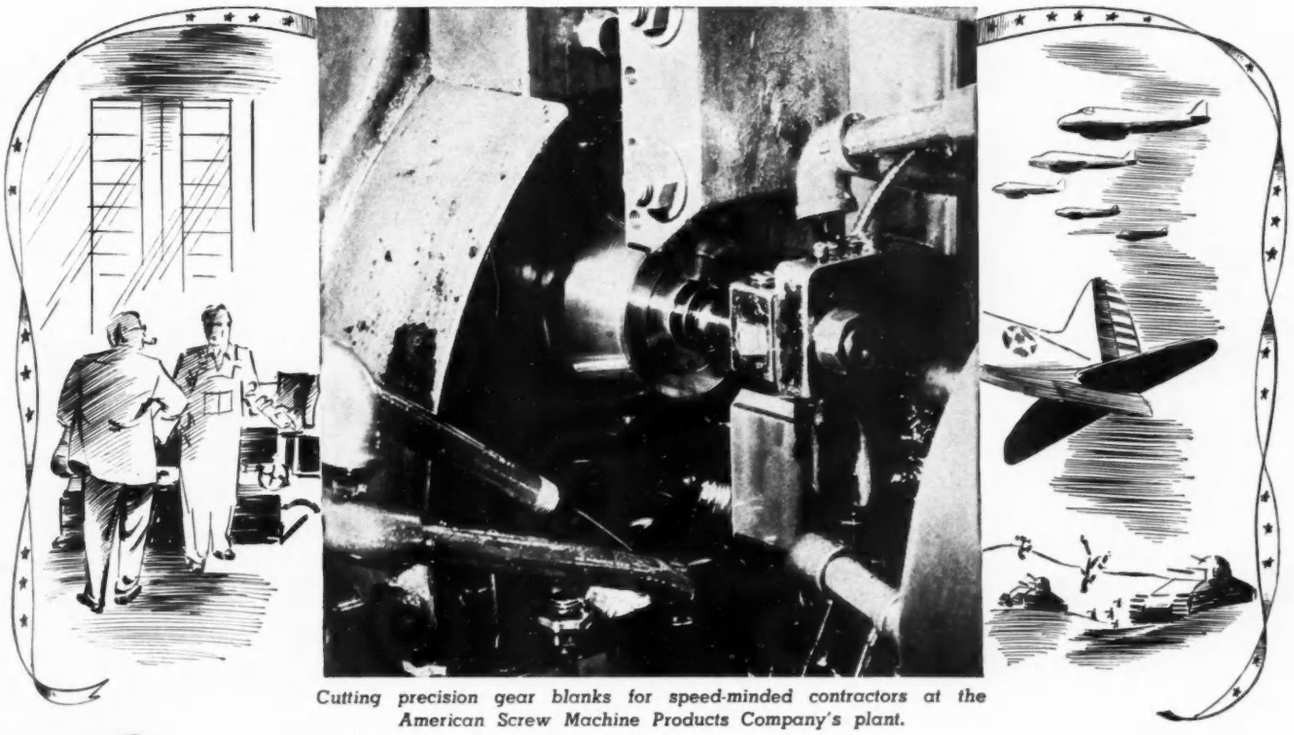

Cutting precision gear blanks for speed-minded contractors at the American Screw Machine Products Company's plant.

"Slick-" CONTRACTOR PRAISES CITIES SERVICE CUTTING OILS

Producing for America's armament is the immediate task of American Screw Machine Products Company. It is one of the many shops specializing in subcontract work where accuracy, finish and speed are paramount. Says Lester E. Hoffman, Production Superintendent: "We've been under terrific pressure, working day and night to meet the schedule demanded of us by the armament program, and we always use Cities Service Cutting Oils because we know they turn out a *slick* job. For the past three years we haven't had a drop of oil in the plant that wasn't Cities Service."

You, too, will find that Cities Service Cutting Oils not only will do a "slick" job for you but an economical one as well. Let us prove this to you the practical way—by a test in your own plant under actual service conditions.

An informative booklet "Metal Cutting Lubrication" is available to the personnel of cutting oil users. Fill out the coupon below and mail for your copy.

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A LUBRICANT FOR EVERY INDUSTRIAL NEED

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(*Continued from page* 29)

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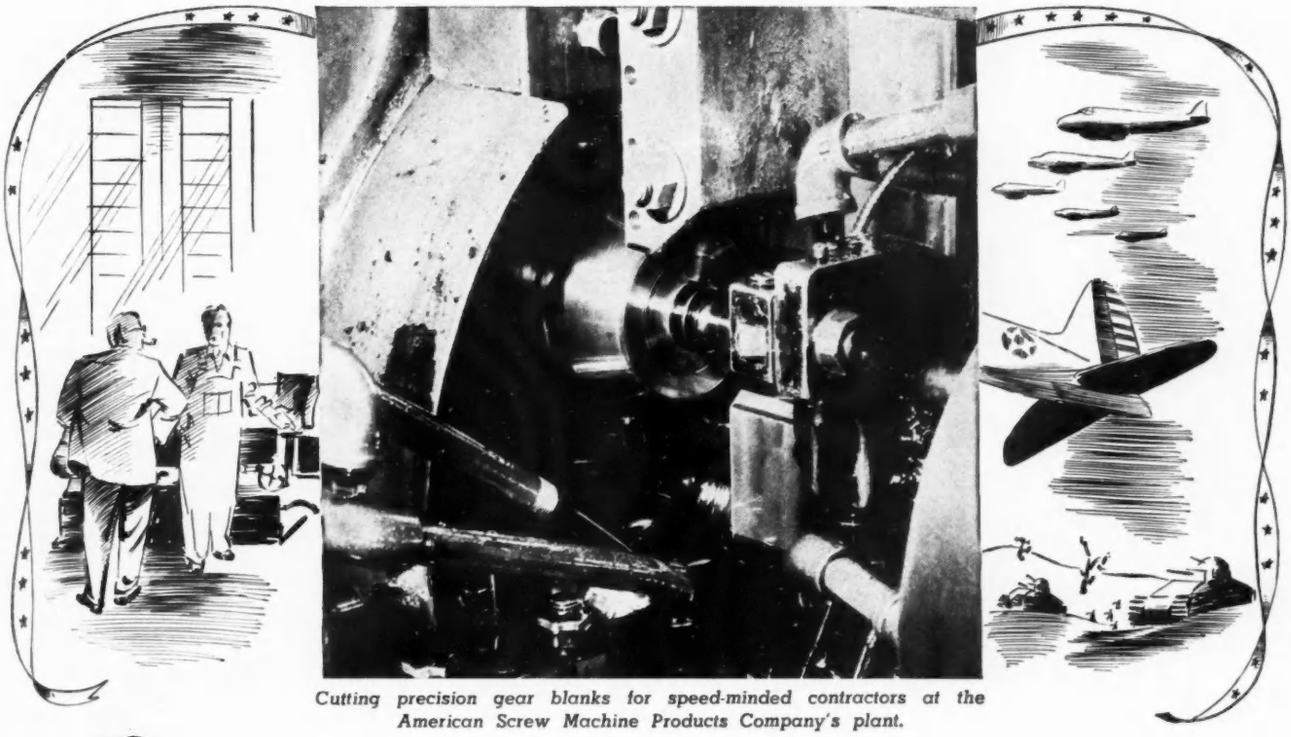

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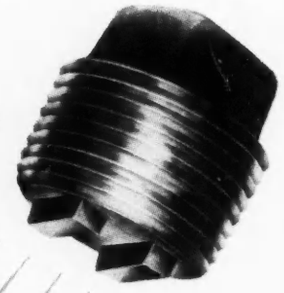

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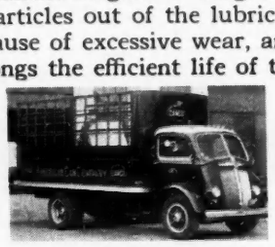
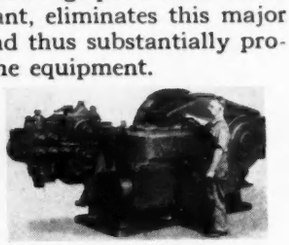
In any product employing gears, bearings, or other moving parts which operate in oil or grease, ordinary friction causes a constant flaking and chipping of the metal. These abrasive metal particles, circulating in the lubricant, result in untold damage to precision parts.

Photo shows cluster of metal particles removed from gear case.

This needless destruction can be stopped, easily and economically, by replacing ordinary drain plugs with Magnetic Drain Plugs. A powerful permanent magnet in Magnetic Plugs pulls these metal particles out of the lubricant, eliminates this major cause of excessive wear, and thus substantially prolongs the efficient life of the equipment.





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Every Magnetic Drain Plug we can make today is needed for planes, tanks, trucks and equipment for war production . . . but it's not too early to think about *your* peacetime products of the future.

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Magnetic DRAIN PLUGS

Kanzler's Latest Report

WAR MATERIAL shipments by 157 companies of the automotive industry increased 46 per cent in the two months from March 1 to April 30, according to the second progress report on the conversion of the industry by Ernest C. Kanzler, chief of the Automotive Branch of the War Production Board. April shipments by the 157 companies, representing 72 per cent of the industry on the basis of employment, totaled $349 millions compared to shipments valued at $239 millions by the same companies in February. This April output is at an annual rate of more than $4 billions.

These shipments include some duplication due to the fact that inter-company sales of partly fabricated parts or subassemblies are not separated from total sales. Possibly a more accurate picture is gained from the "value added" of war products, which represents the difference between money value of shipments and the cost of materials and parts supplied. Value added of war shipments increased 53 per cent in April over February, totaling $188 millions in April for the 157 companies reporting compared to $123 millions for the same companies in February. This is at an annual "value added" rate of $2¼ billions.

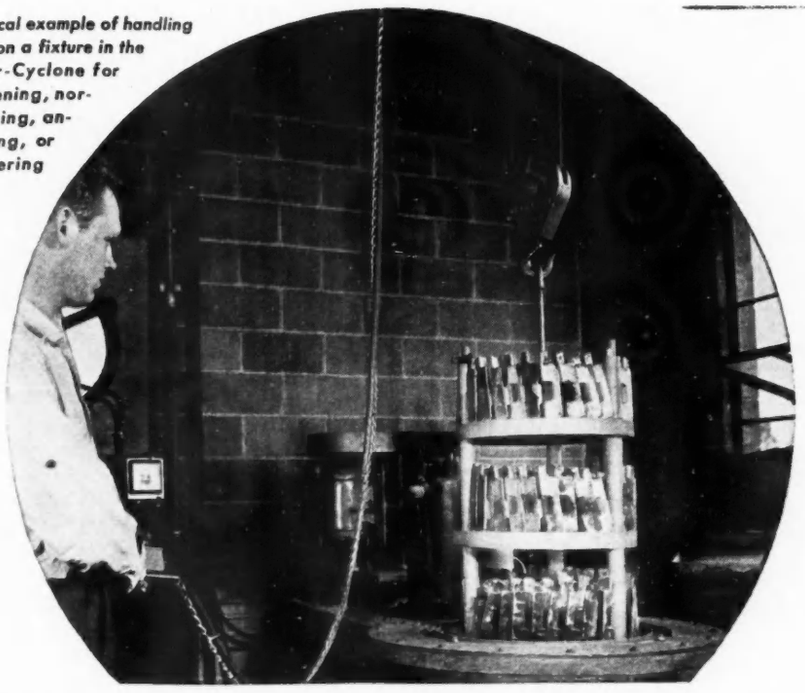
The report for April covered 432 plants operated by 157 companies. One hundred and eighty companies representing 85 per cent of the industry made up the February report. Tardiness of some companies in reporting their shipments due to the tremendous amount of statistical details that must be compiled for Government agencies under wartime conditions was responsible for the smaller number making April reports. Total April shipments of the 157 companies were valued at $420 millions of which 83 per cent was war goods. The remainder was replacement parts and other civilian production that had not been halted by the WPB.

Eight automobile manufacturers, operating 182 plants, which made April reports, showed an 87 per cent increase in "value added" of their war products. The companies reporting were General Motors, Ford, Chrysler, Studebaker, Hudson, Packard, Nash-Kelvinator and Graham-Paige. Nine truck companies operating 10 plants, but excluding one of the largest truck manufacturers, increased the "value added" of their war shipments by 56 per cent during the two months. One hundred and forty parts companies operating 240 plants upped the "value added" of their war shipments by 23½ per cent from February to April.

Non-war shipments of the 157 companies declined 50 per cent from $145 millions in February to $72 millions in April, indicating the tapering off of civilian goods production. Non-war shipments of the eight automobile manufacturers dropped 62 per cent from $106,601,000 in February, when the production of passenger cars and light trucks for civilian use was brought to a halt, to $40,644,000 in April.

Total employment in the 432 plants reporting showed only a 4 per cent gain, probably due to disemployment brought about by the conversion process. Employment totaled 561,480 persons at the end of April. However, man-hours of labor on war work showed a big jump in the two months, increasing 92 per cent from 39 million man-hours in February to 75 million man-hours in April. Tooling and other preparation for war work is not included in the April man-hour figure, so a substantial number of man-hours would be added if the figures were available. Total man-hours on war work increased 72 per cent in the 432 plants but in the 182 automobile manufacturing plants, where the conversion was more abrupt, there was a 160 per cent increase in man-hours on war work.

When these plants reach their maximum war production, it has been estimated that total man-hours will be at the rate of 1350 millions per year. The 75 million man-hours of war work in April was at an annual rate



A typical example of handling work on a fixture in the Super-Cyclone for hardening, normalizing, annealing, or tempering

INCREASED PRODUCTION ★ STRAIGHTER WORK

REDUCED HANDLING ★ LESS FLOOR SPACE

Get them all with 100% forced convection heating in the

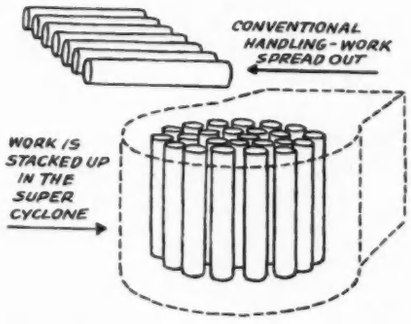
SUPER-CYCLONE

THE NEW HEATING PRINCIPLE embodied in the Lindberg Super-Cyclone combines a hardening, normalizing, annealing, tempering, and nitriding furnace into one. In addition, the 100% forced convection heating principle increases production, turns out straighter work, reduces handling of material, and generally requires less floor space to give all these advantages. And too, due to the heating and control accuracy within its 250°F. to 1750°F. temperature range, the Super-Cyclone is a highly flexible furnace for the small or medium heat treating shop as well as a heavy production unit for the large shop when put to work on one type of job.

REDUCES HANDLING

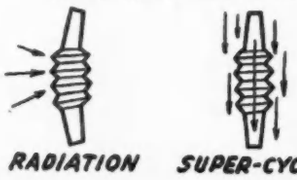
The use of a fixture in the Super-Cyclone eliminates the individual handling of pieces throughout the heat treating process. The parts are loaded onto the fixture and remain there during the heating, quenching, and tempering stages. An added advantage of the fixture is that it can be loaded and unloaded away from the furnace. As a result, the operator is not subjected to high furnace heat as occurs in handling work individually from the box furnace.

INCREASES PRODUCTION



To check the production increases possible in your shop, through the Super-Cyclone, spread an average load of parts on the floor one layer thick, as handled in a radiation type box furnace. Now take another load of those same parts and stack them up in a 36″ circle, 4′ high, making allowance for spacers and supports. Figure it will take a maximum of 3 hours to heat the stacked up parts and 5 minutes to quench the lot. Ordinarily you will find production increases of from 200% to 1000% possible.

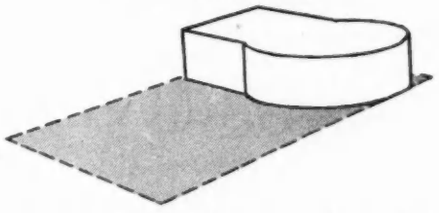
KEEPS WORK STRAIGHTER



The 100% forced convection heating principle of the Super-Cyclone heats the work accurately and uniformly by driving heated air, at high velocity, through the charge. The heat source is confined to a separate chamber, away from the work, thereby preventing heat of a source hotter than the desired work temperature from striking the charge and causing distortion.

Thus, straightening time is eliminated or reduced to a fraction of what is required from conventional equipment. Man hours previously required for straightening are now available for other work.

LESS FLOOR SPACE



As a conservative rule, you can figure that the Super-Cyclone will occupy not more than ⅓ the floor area demanded by any other equipment to handle the same or greatly increased production. This rule is based on averages of what the Super-Cyclone has done in plants all over the country and consequently may not fit all cases.

If you are concerned today with a heavy production schedule, flexibility in your heat treating department, or if your post war plans include economy of operation and maintenance, investigate the Super-Cyclone and all the advantages of its 100% forced convection heating principle. Write for Bulletin 130.

HEAT TREATING HINTS FREE!

Whether the war has brought you into contact with heat treating for the first time or whether you have devoted a lifetime to it, Heat Treating Hints published without charge for heat treaters, offers you valuable "how-to-do-it" information on heating, quenching, straightening, etc.

In the third year of its publication, Heat Treating Hints is read and used by over 8000 heat treaters and metallurgists from coast to coast. Your written request will bring you the latest copy and will place your name on the mailing list for future issues. Write today.

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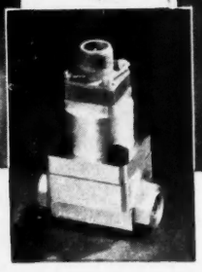
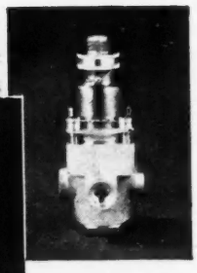
*hi-g Most important operating characteristic of ALL General Controls Aircraft Type Electric Valves is their positive ability to operate in any position, regardless of vibration, change of motion, or acceleration, i.e., substantial increases in "g." That's what we mean by hi-g.

Fast acting, positive operating, light-weight General Controls two-wire electric hydraulic valves are available to handle all fluids, vapors and gases up to 1500 lbs. or more. Available in normally open, normally closed, single seated types, as well as pilot piston operated types. These valves are designed for continuous or intermittent duty. General Controls 3- or 4-way types are for hydraulic control, proportioning, inching, or complicated selector valve arrangements.

Above: Type AV-9; piloted piston type control.

Below: Type AV-3; single seated, nomally closed type.





Above: Type AV-11; 3-way hydraulic control.

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of 900 million man-hours or two-thirds of the way toward the war manpower peak. "However, this does not mean that production has reached the two-thirds mark," according to Kanzler. "As manpower increases toward the peak, production will increase at a greater rate because of mass production methods, more efficiency and better utilization of all manpower."

General Motors, one of the largest automotive contributors to the war effort, shipped $119,332,117 worth of war goods from its U. S. and Canadian plants during May. This marked an 8.4 per cent increase over April shipments of $110,026,600. War material deliveries in the first five months of 1942 totaled $486,838,088 compared to $406,149,273 in the entire 12 months of 1941.

Buick Motor Division of GM, whose June production of aircraft engines was 400 per cent ahead of original schedules, is one of the automotive companies helping boost the monthly aircraft total over the 4,000-plane mark. Increase in output at the new plant at Melrose Park, Ill., has compelled it to boost its production of parts in former automotive plants in Flint. Originally, Flint operations were confined to one factory and part of another where crankshafts, propeller shafts and connecting rods were machined and smaller parts were produced. But production schedule increases have resulted in expansion and shifting of operations. Forgings, originally obtained from outside sources, are now fabricated in the Buick forge plant and the rough forgings are delivered to the machining departments for processing into crankshafts, propeller shafts and connecting rods.

Similarly, airplane engine castings, such as cylinder heads and pistons, are cast in the Buick foundry pending completion of the new aluminum foundry which is nearing completion and which will greatly expand Buick's capacity for castings. Production is going forward on approximately 30 war projects in Buick plants.

Fisher Body Division of GM has helped overcome a bottleneck in the tank production program that threatened to delay the tooling for manufacture of the 28-ton juggernauts not only at Fisher Body but at other automotive plants as well. Vertical boring mills of a large size were needed to machine the armor plate for the tanks. With all machine tool facilities jammed with war orders, the WPB asked Fisher Body to produce such boring mills about six months ago. At the time Fisher Body already was engaged in making giant planers for naval ordnance work and other war jobs.

Fisher Body adapted automotive know-how derived from automobile body building practice to the production of these machines. A machine which for years had served only one purpose was converted to two uses—both new. Parts of boring mills were adapted into fixtures so that, in effect, one mill held another in place while three separate operations were performed upon it. This development resulted in a 12-hour time saving in the manufacture of each boring mill. Special hooks and grapplers were devised to handle the parts and speed construction. Special leveling blocks were perfected and the big planers were utilized to expedite manufacture. This has enabled Fisher Body to fill not only its own needs for vertical boring mills but to supply other tank manufacturers.

Continental Aviation & Engineering Corp., a research affiliate of Continental Motors Corp., which has been doing development work on military aircraft engines for several years, has been awarded a facilities contract by the government for the erection of a new plant for volume production of aircraft engines. The plant will be in an undisclosed Michigan city. Continental Motors already is manufacturing aircraft type engines of various sizes in Detroit and Muskegon.

The new plant will have exterior walls and piers of brick, but interior columns, trusses and sash will be of wood to save critical materials. Mass concrete footing without reinforcements will be used. The main building will be the largest wood truss structure to be built in Michigan in many years. The building will be of one-story construction except for a 40-ft. deep mezzanine across the front, which will house the drafting dept., with offices below. Test cells will be of reinforced concrete.

Companions in PERFORMANCE!

Yes sir, *ANOTHER* Namco "Double Duty" Tool—

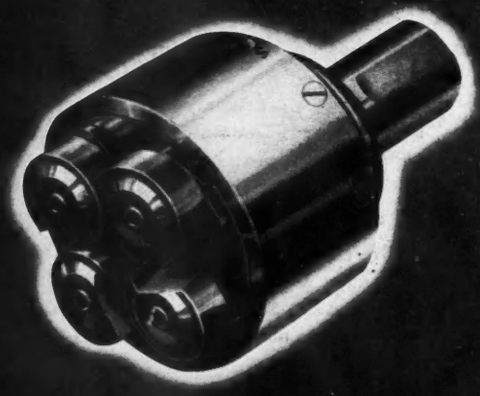
THE NEW "RS" COLLAPSING TAP

Remember—Namco "DR" and "DS" Circular Chaser Dies use interchangeable chasers and are also quickly adapted to hollow milling by substitution of cutters and holding blocks.

By similar economical planning—*One Basic Design* in the new "RS" Tap serves both revolving and stationary spindle machines. Quick and positive opening action, fine diametric adjustment and ground thread chasers offer the same precision and trouble-free production you are now getting from Namco Dies. Ask for proof of this outstanding performance.

"RS" Collapsing Tap—Five sizes—1-1/4 to 2-13/16" with blade chasers. Larger sizes up to 5" with circular chasers. Shown equipped for stationary spindle.

"DS" Circular Chaser Die for stationary spindles. Sizes 3/8 to 4-7/8". Readily adaptable to Hollow Milling work.



"DR" Circular Cutter Hollow Milling head for revolving spindles. Sizes 5/16 to 4-7/8". May be quickly changed for threading.

THE NATIONAL ACME CO.

170 EAST 131ST STREET • CLEVELAND, OHIO

ACME-GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS • SCREW MACHINE PRODUCTS • THE CHRONOLOG • LIMIT SWITCHES • SOLENOIDS • POSITIVE CENTRIFUGE • CONTRACT MANUFACTURING

Aluminum Scrap

(*Continued from page* 37)

should be made to trace the error back to the offending department and person.

No two plants operate identically, so the segregation program must be tailored to fit individual factory conditions. Some of the factors to be considered are: (1) the number of different metals and alloys being processed; (2) the tonnage of scrap generated each day from each aluminum alloy; (3) the type of scrap (whether solid or turnings); (4) packaging and shipping facilities for scrap; (5) available storage space; (6) location of the plant with respect to an aluminum plant where the scrap can be utilized.

There are fortunately some axiomatic principles of scrap segregation that will apply almost everywhere. For instance, segregation should begin right at the machine that generates the scrap. When work on a given machine is changed and another alloy or metal is to be used subsequently, the scrap box should be shifted to the proper one for the new metal immediately, and the machine thoroughly cleaned before beginning the new job.

A scheme for identifying the different alloys and metals so that they are recognizable at a glance can be worked out easily. Covered scrap boxes can be provided for each alloy, and the kind of scrap it is to hold marked in bright, bold characters on its sides and cover. Or, containers of various colors for different materials—the color matching the job-ticket color on the metal being used—are also suggested.

Identification should be carefully preserved right up to the time of shipping scrap to the reprocessing plant. Poor packaging, faulty identification, and careless loading of scrap are distinct handicaps to the receiving plants because of accidental mixing between the point of origin and the reprocessor.

Sheet scrap in the lighter gages is usually put up in the form of a briquette or small, tightly-compressed bale, before being remelted. It is wise to package heavy plate scrap, extruded shapes or rod ends separately, since the baling or briquetting machines may jam and the final briquettes fall apart or be difficult to handle when mixed scrap of this kind is being processed.

Conservation in Buying

Aluminum production can be speeded up and a long step taken toward efficient conservation if companies using aluminum sheet buy with considered judgment. It is worth some study to see if correct standard sheet sizes are being ordered. Of course, specifications that are too rigid often place an unnecessary burden on the producer, with a resultant rise in raw material costs.

Aluminum rolling mills can best obtain their maximum capacity by making large stock runs without changing alloy or gage. The sheet produced is then sheared to size. If large sheet in specified sizes is made, a large amount of smaller sheet is often produced which, unless there is a market for it, must be tossed into the scrap basket for remelting. Often fabricators who order only large sheet could use a considerable percentage of smaller sheet with a minimum of replanning. A little ingenuity will frequently permit these small sheets to be used without reprocessing or rerolling. From an economic standpoint, this often pays, as producers may offer price advantages if the customer will take 80 per cent of an order in specified sizes and 20 per cent in "random standard" size.

Raw material costs may also be reduced by the use of a larger number of alloys by manufacturers. Demands for 24S alloy, for instance, have increased tremendously since the national plane-production program has gotten well under way. Some manufacturers go on ordering it just from habit. Yet cases have been found where 24S was being specified as a matter of routine when lower-priced, more easily-worked alloys such as 3S, 53S, and 61S would do as efficient job, perhaps a better one.

This is no place for a LOOSE NUT

. . . and that goes too for thousands of other vital positions on America's fighting airplanes where careful designers have placed Elastic Stop Nuts. These self-locking self-gripping fastenings have proved, through fifteen years of reliable service on aircraft, that they remain tight under all combinations of vibration, stress, shock, exposure to weather, and prolonged heavy duty. They are used today on *every* military and transport airplane built in the Western Hemisphere.

There are more Elastic Stop Nuts on America's airplanes, tanks, Naval vessels, and other war equipment, than all other lock nuts combined.

•

ELASTIC STOP NUTS may be the solution to *your* fastening problems. Sample nuts, for testing, will be furnished without cost or obligation.

•

» Write for folder explaining the Elastic Stop self-locking principle

ELASTIC STOP NUT CORPORATION • 2339 VAUXHALL ROAD • UNION, NEW JERSEY

WITH THE RED LOCKING COLLAR . . . . SYMBOL OF SECURITY

for freedom from "cold," burned or warped short-time resistance welds

Get rid of "transients"

with Westinghouse SYNCHRONOUS TIMERS

"Transient" currents resulting from random (nonsynchronous) switching on short-time resistance welds can cause up to 50% variation in equally timed welds. This unpredictable heat may thus produce either a burned weld, a good weld, or a cold weld for the identical timing setting.

Westinghouse Synchronous Timers eliminate these varying and unpredictable power surges. Weld current is synchronized—always starts and stops *at the correct point of the wave!* Thus every weld is a duplicate of the last one because the wave form is the same. No rejects or pitted electrodes due to overheating. Just a steady succession of uniformly strong welds, neat in appearance, and with excellent metallurgical characteristics.

Westinghouse Synchronous Timers are available for either spot or seam welding, and the latest model is a combination for spot, seam, or pulsation welding, fully electronic. Ask your Westinghouse representative to give you the latest information on Westinghouse Electronic Control for resistance welding. Or write Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N.

J-21224

5 WAYS

To Increase Weld Production with Westinghouse Synchronous Timers

1. *Increase weld quality and uniformity* on short-time welds of thin pieces and critical metals.
2. *Reduce inspection time.* With consistent quality of welds, minimum inspection is required.
3. *Reduce rejects.* Burning, warping, discoloration and similar faults due to unpredictable transients are eliminated.
4. *Reduce finishing.* Special finishing and grinding is not usually necessary.
5. *Reduce maintenance.* Electrode wear is greatly reduced. Ignitron power switch has no moving parts.

Westinghouse

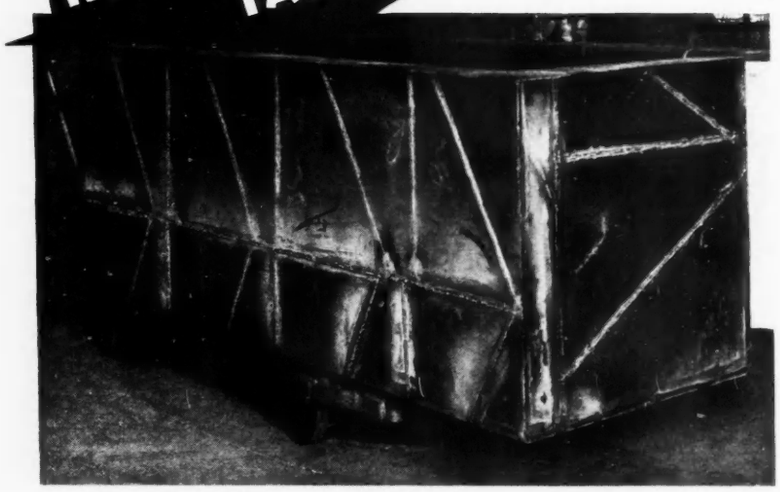
RESISTANCE WELDING CONTROL

Steel Hardenability

A tentative method of end-quench test for hardenability of steel has been issued by the American Society for Testing Materials. It was evolved by a sub-committee under the chairmanship of E. W. Upham of the Chrysler Corp. The arithmetic method of plotting test data is recommended, instead of the logarithmic method, which has been used to some extent in the past (see AUTOMOTIVE INDUSTRIES of Jan. 15, 1941). The arithmetic method is the one used in the Iron and Steel Institute Manual No. 5 on Possible Alternates for Nickel, Chromium, and Chromium-Nickel Constructional Alloy Steels.

Hardenability is measured quantitatively, usually by noting the extent or depth of hardening of a standard size and shape of test specimen in a standardized quench. In the end-quench test the "depth of hardening" is the distance along the specimen from the quenched end for a given degree of hardening. In the ASTM method the test specimen is 1 in. in diameter by 3 or 4 in. in length, but optional specimens are illustrated. Requirements are given for heating, quenching, and measuring the hardness.

SCRAP STEEL USED FOR HOUGHTO-BLACK TANK



for Blackening Steel Parts

● A Michigan metal parts manufacturer urgently needing a tank for blackening steel, showed its ingenuity by building the tank shown above from 56 pieces of scrap steel collected around the plant. Today this tank is turning out thousands of blackened parts on a production basis, using this single-bath treatment.

HOUGHTO-BLACK is a low temperature blackening solution which is rapid, economical and provides a durable, attractive and protective finish to metal parts without altering dimensional sizes. Operating at 290-295° F., with pre-clean and hot and cold rinses, this process is now being used for a myriad of applications.

It will pay you to investigate HOUGHTO-BLACK! Ask the Houghton Man, or write for factual folder at right.

E. F. HOUGHTON & CO.
PHILADELPHIA
Chicago ● San Francisco ● Detroit

HOUGHTO-BLACK

PESCO Plant

(*Continued from page* 41)

Ex-Cell-O precision boring machines, supplemented with one Heald machine.

Gears for the pumps and the serrated driving shaft ends for various units are cut in Fellows gear shapers. For this purpose, Pesco has a sizable battery of the familiar new high speed Fellows gear shapers.

Parts production is replete with many milling machine operations. Accordingly, we find several rows of the new heavy duty Kearney & Trecker milling machines, mostly of the familiar Model H type. In addition, there are a number of the Sundstrand Rigidmill machines to round out these facilities. Grinding is an exacting finishing procedure here since the parts must pass muster not only as to dimensional tolerances but as to fine surface finish as well. These requirements are assured in an excellent grinding department tooled principally with latest types of Norton grinders. This department also boasts one of the new Ex-Cell-O precision thread grinders. A long line of universal type engine lathes running the gamut of sizes from the very small to the large geared head lathes is set up for a variety of turning operations.

One of the newest departments placed in operation here consists of an outstanding battery of six-spindle National-Acme Gridley screw machines. Here, too, is found one of the Blanchard surface grinders. In all, they have four of the Blanchard grinders, which are doing an excellent job of finish-grinding the sides of small gears, held to exacting standards as to size, finish, and flatness.

Quite apart from the machine shop is a well-equipped plating department designed for the anodizing of aluminum parts and the cadmium plating of a variety of small ferrous parts. Another interesting activity is the self-contained and fully enclosed department for the general run of polishing, filing, and burring operations. This is an important part of the fabrication procedure, includes many hand operations as well as portable tool operations.

Due to the exacting requirements of quality control, all machined parts are cleared through a final inspection department where they are checked by Pesco inspectors as well as representatives of the services. Only the accepted parts are permitted to be cleared to the assembly department. Significantly, the major part of the gaging equipment consists of items of the familiar Sheffield gages of 1000 to 1 magnification. In addition, they have several of the P & W Supermicrometers for certain of the gaging work. This department also is provided with a small Magnaflux unit, so widely employed in war production inspection, for the surface inspection of ferrous parts.

A large assembly department, containing small assembly benches, has been set up for the assembly of the

Over 215 Million Square Feet of Blueprints Every Month!

PRODUCED ON PEASE EQUIPMENT AT U. S. ARMY AIR FORCES, MATERIEL CENTER

World's Largest Blueprinting Plant—the Production Engineering Section of the Materiel Center of the Air Forces—produces over 215 million square feet of Blueprints every month . . . Blueprints of sleek training planes, deadly fighters, mighty bombers . . . Blueprints of instruments, wings, landing gear and countless other parts . . . Blueprints as large as 3' x 50' and as small as 4" square . . . in fact, enough Blueprints to make a strip one foot wide and over 40,000 miles long.

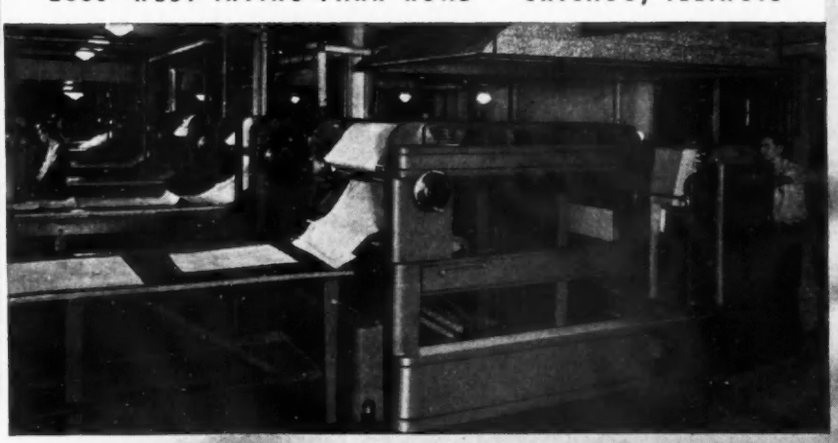
This gigantic task calls for 3 eight hour shifts, running a battery of 26 streamlined Pease Model "22" Continuous Blueprinting, Washing, Developing and Drying Machines, without interruption, 24 hours a day, month in and month out . . . unquestionably proving the value of Pease advanced design, rugged, trouble free construction and outstanding, exclusive features . . . a combination which is making this quantity production of quality prints at low cost an every day occurrence.

SPECIAL PEASE FEATURES THAT SPEED PRODUCTION

- ★ Sliding "Vacuum-like" Contact smooths out tracings.
- ★ Three Speed Lamp Control accommodates all types of tracings without change of running speed.
- ★ Actinic "No-Break" Arc Lamps give unusual uniformity of light.
- ★ Horizontal Water Wash free from tension—prevents wrinkles.
- ★ Quick Change Blueprint-Negative print Chemical Applicator—economical, avoids stained prints.
- ★ Eight-inch Drying Drums, arranged horizontally, prevent pockets formed by rising steam.

THE C. F. PEASE COMPANY

2635 WEST IRVING PARK ROAD • CHICAGO, ILLINOIS



Official Photographs furnished by the U.S. Army Air Forces

★ Actual photograph of Pease Model "22" Continuous Blueprinting, Washing, Developing and Drying Machines installed at the Air Forces, Materiel Center.

Blueprinting Machines A TYPE AND SIZE FOR EVERY REQUIREMENT INCLUDING DIRECT PROCESS PRINTING

Pesco line of accessories. It is mostly a hand operation manned by skilled operators who are able to take the variety of units, with their endless variations in specifications, in their stride.

As might be expected, the largest area of the plant is set apart for the testing calibration, and running-in of the various accessories. Fuel pumps are handled in a separate department with adequate fire and safety protection incident to the use of high test gasoline. This section is fitted with safety lighting equipment and explosion-proof electric motors. The fuel pumps are subjected to flow bench calibration, to a drive test, and to other test procedures before acceptance. Vacuum pumps are subjected to a run-in test and to a calibration test. Motor driven pumps are checked for torque to make sure that the power draw is within the specifications. There also is a large department fitted with equipment for the running-in of various units. Finally, it may be noted that all of the accessory units including the valves are put through their paces 100 per cent to assure their fitness for installation on prime equipment intended for use of the military services.

One other activity is worthy of special mention. To facilitate the checking of fuel pumps and vacuum pumps of any make out in the field, Pesco has developed a self-contained portable testing outfit which is produced on order for outside use. These test stands are complete in every respect and provide instrumentation for the checking of pressure, vacuum, flow rate, etc.

The foregoing is intended to provide a succinct but comprehensive picture of the Pesco manufacturing setup. Because the basic philosophy of the layout is one of flexibility, it is difficult to be more specific as to details.

IN THE THICK OF THE FIGHT ON
All Production Fronts
HANSEN MFG.
HANSEN Push-Tite
AIR HOSE COUPLINGS
Hansen Push-Tite air hose couplings have played an important part in the phenomenal production records now being established by the leading industrial plants in this country. The unique design of these couplings means far less effort for the operator, saving of air, time and a general all 'round speeding up of production.
Slight push of plug into socket—it is connected and at the same time air is automatically turned on—slight pull back, air is automatically turned off and coupling is disconnected. Absolutely air tight—no leakage or wastage of air. No twisting of parts in order to connect or disconnect, no kinking of hose due to complete swivel action.
Hansen Push-Tite air hose couplings are widely used for air, oil and grease lines.
Hansen MANUFACTURING CO.
1786 E. 27th ST. • CLEVELAND, O.

Bullard Reclamation

(*Continued from page* 45)

The main storage hopper is divided into compartments to permit the segregation and reclamation of the various alloys. The feed from this hopper to the briquetting press is by gravity through a controlled opening provided in each compartment, after which the briquettes are taken to various bins in the foundry yard. This system is flexible in design and has reduced manual handling to a minimum. Its simplicity has left it relatively free from maintenance problems.

The briquettes are disposed of in two ways, first the alloy briquettes are returned to one of our alloy steel suppliers, and secondly, the remainder of the briquettes fill 35 to 40 per cent of our foundry needs. In some heats, as high as 50 per cent briquettes are used with entirely satisfactory results.

The importance of an educational campaign in connection with the establishment of a reclamation program, cannot be stressed too strongly. The educational program should appeal to every man in the shop, for only through complete cooperation, can this vital job be done.

Courtesy of Army Motors

Military Wheel

Wheels of this construction, known as the runflat or combat type, are used on Army military vehicles to enable them to be taken out of danger when the tire is shot flat.

HAND FINISHING A ZINC ALLOY DIE

ZINC IN WAR

SPEEDING PLANE PRODUCTION

Sand cast dies of zinc alloy are used for stamping many sheet metal aircraft parts. This procedure saves time and money over the practice of machining dies from tool steel. Thus zinc is playing an important role in helping the aircraft industry to meet the demand of our fighting forces for "More Planes—Sooner"

Dies of unalloyed zinc were used in the days of limited aircraft production. But larger production has proved that a zinc alloy, originally developed for the die casting industry by this Company, and known as Zamak, provides additional advantages in the production of stamping dies.

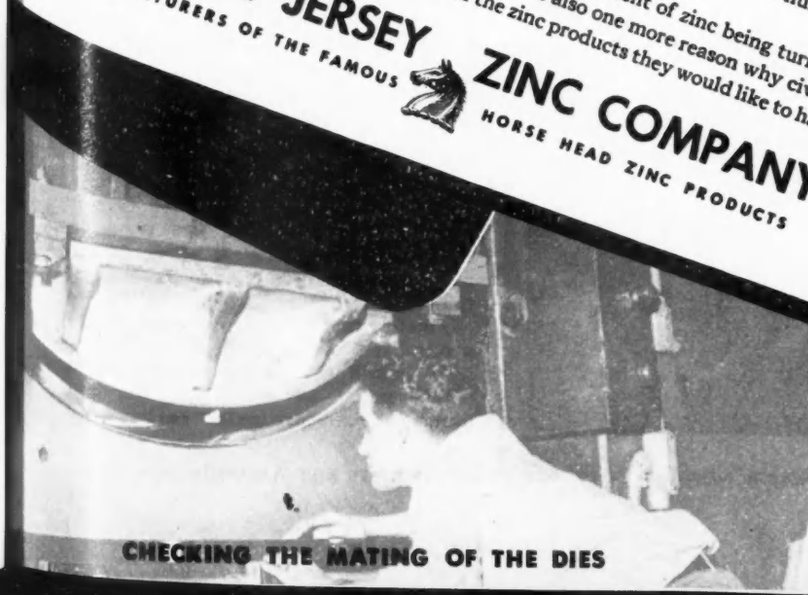
The physical advantages of Zamak alloy dies include greater strength and hardness, less warpage, smoother surfaces and increased wear resistance. All of these factors contribute to longer production life, thereby cutting down the number of dies to be made—and fewer dies mean faster production.

This is just another instance of a peace-time development of zinc being turned to effective use in the War Production Program. It is also one more reason why civilian users of zinc may not be able to obtain all of the zinc products they would like to have.

THE NEW JERSEY ZINC COMPANY

MANUFACTURERS OF THE FAMOUS HORSE HEAD ZINC PRODUCTS

9 STAMPING DIES
GALVAN-IZING
1 HULL PLATES
2 RUBBER
3 PAINT
4 BRASS
5 CERAMICS
6 DIE CASTING
7 PHARMA-CEUTICALS
8 METAL SPRAYING



CHECKING THE MATING OF THE DIES

DETERMINING FURTHER FINISHING REQUIRED

Chrysler Packaging System

(*Continued from page* 43)

second echelon handles only minor repair jobs that can be done expeditiously along the route and thus carries a smaller but highly specialized supply of spare parts than the third echelon, which is fairly well stocked for repairs in the field for a mobile shop. The fourth echelon has the largest stock and assortment of spare parts, taking care of major jobs like engine or axle.

Following the sort by echelons, the parts were divided again on the basis of government group numbers, which would permit a ready breakdown of spare parts uses. Then began the tedious task of developing a packaging system that would keep the parts sorted by interchangeability, echelon and government group number and at the same time place them in a handy box easy to handle. It was decided to standardize on a tongue-and-groove export-type wooden box. A hinged lid was developed for those boxes containing more than one part. Thus the boxes are convertible to other uses in the field after their spare part contents have been exhausted. They can be used for food, ammunition or medicine.

A weight limitation of 200 lb. gross was set up for the boxes so that they can be carried easily by any conveyance in the field, even by a pack animal or on a soldier's back if necessary. This also necessitated their limitation as to bulk, with 12 cu. ft. set as the maximum. The smallest box contains ¾ cu. ft. There are necessary exceptions to these standards. The box containing a replacement engine weighs 730 lb. and the box housing the rear or front axle contains 14 cu. ft. The replacement engine box also has a screwed lid so that the replaced engine can be returned in it for rebuilding or salvage. The radiator core also is shipped in a single box. To meet all these conditions it was necessary to work out 90 different wood box sizes and 249 boxes were required to ship the full complement of 34,000 parts for a 100-truck unit.

In order that climatic changes could be overcome, great care was exercised to wrap and package the parts so they would be protected from the elements. In the search for a waterproof wrapping, Chrysler parts experts thought of the various things that must be protected from moisture and rust. Finally they hit upon an oil pipeline. After investigation it was found that an oil-treated cloth was used to protect certain pipelines. This was found to meet all the specifications needed to protect the parts from rust.

In preparing for shipment abroad, all metal parts for which it is practical are treated first with a rustproofing material which is composed of a petroleum wax compound with an inhibitor. This makes parts such as valves impervious to damage from sweating and can be removed easily when the parts are ready for use in the field. Application of heat only spreads the compound on the part.

Inadequate rustproofing was a handicap in servicing trucks operating under the Chinese on the Burma Road. When some spare piston rings arrived in India with rust spots, the Chinese mechanics went to work on them with sandpaper. They not only removed the rust but ruined the surfaces, making them useless for replacement purposes.

After rustproofing, the part is wrapped in the oil-treated cloth, which contains the same basic elements as the rustproofing solution. Then it is placed in a wax-treated paper box. Several of the paper boxes are then placed in a double wax-treated corrugated carton. The cartons are then put inside a waterproof bag, which is placed in the wooden box for shipment. The top of the wooden box is sealed with a piece of waterproof cloth and steel bands are affixed on the outside to assure safe handling. Seven hundred and eighty paper box sizes and over 100 different size corrugated cartons are

STERLING ENGINEERS are SPECIALISTS in Designing and Producing PISTONS

★ The accumulated experience of Sterling's 15 years as a leading builder of automotive pistons is now being devoted to the development and production of pistons for our nation's War Production Program.

Exclusive Sterling designs and patented molding processes are conducive to high quality and quick deliveries.

Wire, 'phone, or write for complete information.

STERLING ALUMINUM PRODUCTS
Incorporated St. Louis, Mo.

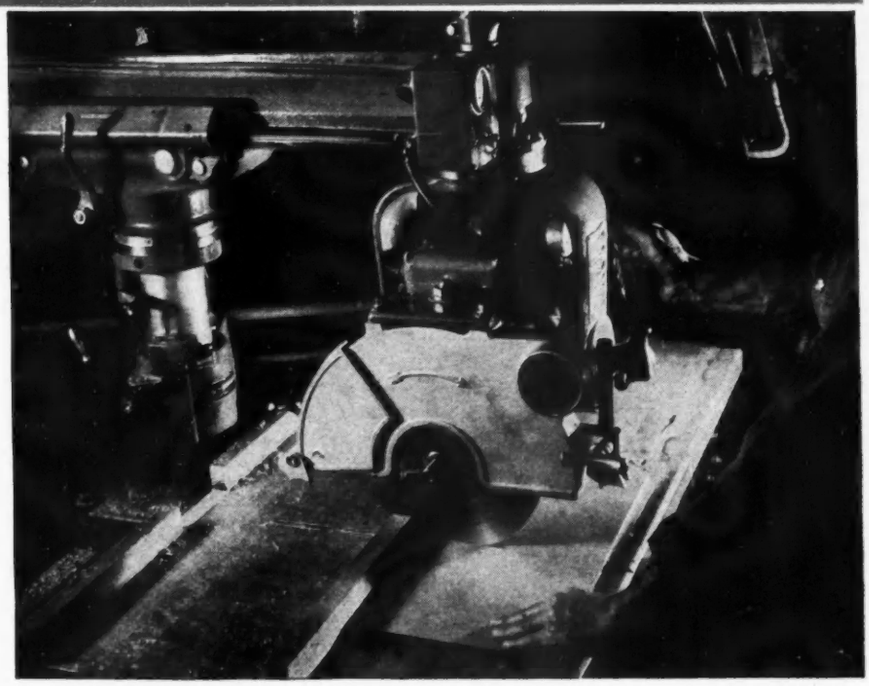
LET'S GO! U.S.A. KEEP 'EM ROLLING

STERLING PISTONS

HOW TO SAW DU PONT "LUCITE"

Transparent Acrylic Sheeting

Information for aircraft manufacturers and their established enclosure suppliers



STRONG, crystal-clear, Du Pont "Lucite" methyl methacrylate resin sheets may be cut with circular, band or jig-saws similar to those used for wood and metal. Linear tolerances of ±1/64" may be readily maintained on cuts of less than 12 inches. On longer cuts ±1/32" to ±1/16" tolerances may be held. Closer tolerances can be attained, depending on results required and degree of care employed. To prevent scratching and marring of the sheets, wherever possible masking paper should be left on. In general, feed "Lucite" slowly to avoid chipping.

LAYOUT. Where extreme accuracy is not required, cutting lines may be laid out on the masking paper. For close tolerances, it is advisable to scribe lines on the material's surface. It is best to use a layout template (made from pieces of "Lucite" sheeting or light gauge metal), especially for curved lines.

CIRCULAR SAWING. Type of circular saws used for "Lucite" are: a *portable saw* for straight cuts where accuracy is not essential; a *table saw* for pieces not too large to be fed (but stiffener washers are desirable at the shaft to reduce blade vibration); and a *movable type saw* most practical for parting large sheets. Circular saws should be hollow-ground. Blades with 5 to 8 moderately fine teeth per inch and no set work well running at about 10,000 feet per minute.

BAND SAW CUTTING. Band saw blades operate at a cooler temperature and are best suited for cutting thick "Lucite." Wide blades with 8 to 22 teeth per inch and no set are most satisfactory for straight cuts. A narrower blade *with* set is required for curves. For work one inch or more thick, use a 22- or 23-gauge blade; on lighter work, a 26- or 28-gauge blade. Best speed for all blades is 1000-1500 ft. per minute.

JIG SAW CUTTING. Blades should be of metal-cutting type. The curve determines the number of teeth to be used, and width of blade. Jig saws for curves with small radii (and band saws for larger curves and straight, thick cuts) need accurate blade guides. With "Lucite," it is harder to bring an off-course saw back to the cutting line.

LUBRICANTS. A stream of water on the leading edge of the saw is the best lubricant to reduce heat, chipping and gumming. If you have a heavy cut, it eliminates "smoke" and possible smearing of the edge. Oil may be used as the lubricant, applied to the blade with a brush. Oiled paper may be placed between sheets of "Lucite" in multiple piece cutting.

"Lucite" stock over one inch thick is often pre-cooled with dry ice (solid carbon dioxide).

Blanking and Punching

These operations can be accomplished with special care on very thin sheets, which must be heated to avoid chipping and cracking. Underheating will cause cracking; overheating will cause the sheet to squeeze and form concave edges. If blanking or punching is desirable, remove masking and use hard, sharp metal dies with plenty of clearance. For straight cutting where great accuracy is not necessary, here's a quick method; Scribe sheet evenly and deeply; split along scribe line by lining it up with edge of table and pressing down on overhanging section.

Call Du Pont for more details and assistance on forming, machining, mounting, and designing of "Lucite" transparent enclosures. Most airplane plants are using the clarity, weather-resistance, light weight and strength of "Lucite" in their airplane enclosures. E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, N. J.; and 5801 So. Broadway, Los Angeles; 350 Fifth Ave., New York City; 1808 No. American Bldg., Chicago; General Motors Bldg., Detroit.

DU PONT REG. U. S. PAT. OFF. "LUCITE" REG. U. S. PAT. OFF.

METHYL METHACRYLATE RESIN

used in packaging the 34,000 spare parts.

The rustproof and waterproof precautions will assure long preservation of the parts even under adverse conditions. If any boxes happen to be dropped into salt water while being transferred from ship to shore during landing operations, the immersion is not expected to affect the parts, since they are so well protected. Most of the parts boxes, with the possible exception of the engine, axles and a few other heavy items, are bouyant enough to keep afloat. The wrapping protection also will make it possible to bury boxes of parts in sand, earth or swamp for strategic reasons. When the motorized troops return to that area, the boxes of parts can be dug up and the parts will be available for immediate use. Moisture and heat cannot get in to affect the contents. The parts are protected against 100 per cent relative humidity or 200 degrees of accumulated temperature.

The protection afforded the parts also will make them available to the Army for use years after the war is over. It is estimated that the oil-treated cloth will give them protection for at least 10 years against rust and moisture. In fact, an engine bearing that had been wraped in this type of cloth for 14 years recently was discovered and no trace of rust or deterioration was found on it. After the last World War, millions of dollars worth of spare truck parts were left in France to rust or were sold by the Army for scrap following the Armistice. But under this new packaging system the parts can be kept by the Army for future use, with little likelihood of their deterioration.

Painstaking efforts have been taken by Chrysler parts experts to see that all parts are properly identified. The hypothetical case of a former soda jerker who is drafted into the Army and finds himself working in a spare parts depot in Eritrea was taken as an example in setting up the identification system. Then the object was set forth to make the identification system so simple that this ex-soda jerker could locate and identify any needed spare parts with the utmost dispatch and efficiency.

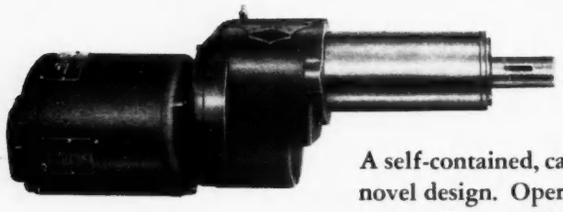
Every wooden box of spare parts has a metal plate, which is salt waterproof, that is attached on the exterior of the box. On this plate are etched the order number, Army parts serial number and the Chrysler parts number for the contents. Each carton or paper box in the wooden box has the vehicle name, part name, Army group number and Chrysler part number printed on all six sides of the container. Tage are substituted for paper boxes in some cases. Every fifth wooden box contains a box directory which details what parts are contained in each of the 249 different wooden boxes.

Every wooden box also is designed and packed so that the cartons containing every type of part in the box are immediately visible upon opening the cover. Thus it is not necessary to dig under several layers of boxes to find some part that the shipment contains. All parts are immediately accessible for use on the surface. To achieve this result, it is necessary to fill in crannies in some of the boxes with pine wood blocks but this is well justified on the basis of the efficiency and simplicity of the Chrysler parts packaging system.

Chrysler has been the pioneer among the automobile companies in developing such a thorough and scientific packaging plan for spare parts for the fighting forces. It had its origin in the unit pack of spare parts for dealers which Chrysler undertook in 1938. A corollary of this was the development of service repair parts kits containing all essential parts for a particular repair job. So when the Quartermaster Corps asked several of the automobile companies to develop a plan for shipping spare parts for motorized equipment abroad, Chrysler had considerable background in this field. Peacetime export experience was not too helpful because only minor precautions of rustproofing had to be taken for a voyage of three to six weeks to a foreign dealer's stockroom. The conditions of war are quite different and offer much tougher problems of stocking and protection.

Rehnberg-Jacobson

DRILLING OR TAPPING UNITS

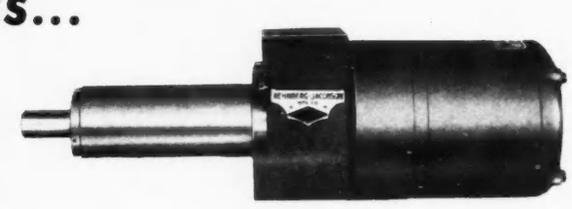


DRILL UNIT

A self-contained, cam-operated drill unit of novel design. Operates through a complete cycle and stops. No base required, mounted by finished cylinder and flanges. For plain, step, or center drilling, or spot facing. Can also be used for milling. Four sizes for 3/16" to 1½" holes in steel. Write for data and specifications.

USE THEM ON YOUR OWN MACHINES...

TAP UNIT



A self-contained tapping unit with interchangeable lead screw, reversing limit switches, and built-in "plugging" switch for controlling reversible motor. Like Drill Unit above, can be mounted on finished cylinder and flanges, and is adaptable to any type of machine requiring one or more units. Widely used by manufacturers of special-purpose machinery requiring dependable units to be located in specified positions. Four sizes available, for tapping same size holes as corresponding drill units. Write for complete data.

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